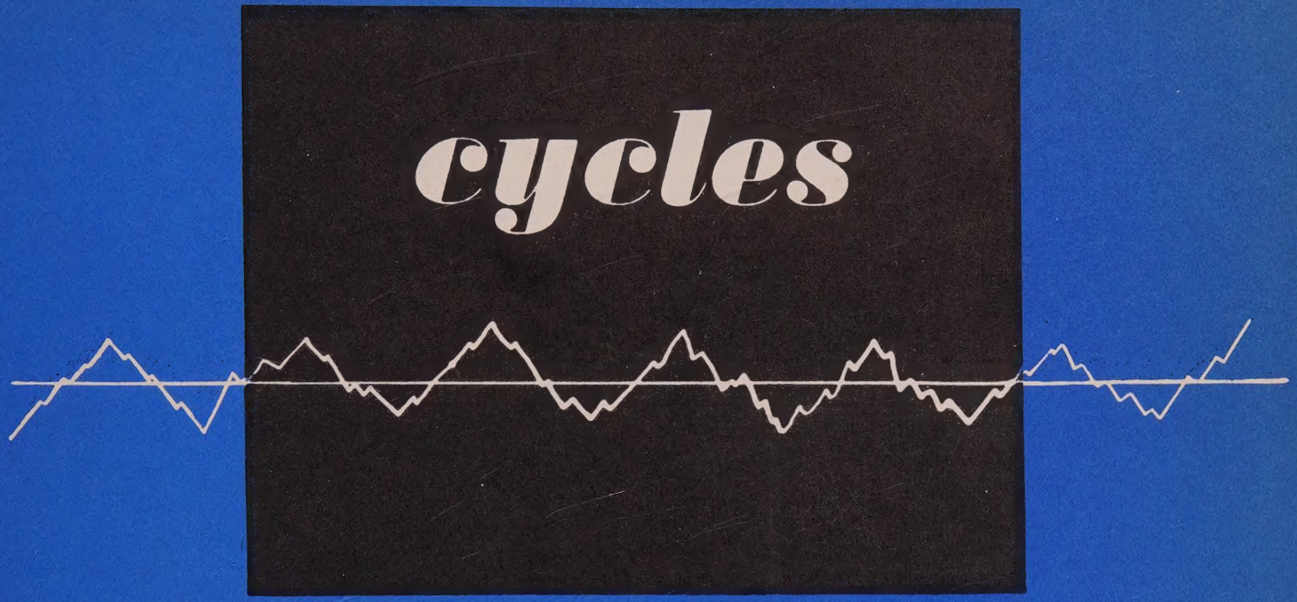
cycles



November 1956

FOUNDATION FOR THE STUDY OF CYCLES
New York, New York

CONTENTS

Page
THE DIRECTOR'S LETTER 287

RESEARCH

The 7.94 and 8.39-Year Cycles in Railroad Stock Prices, 1831--1955 289
Trend and Cycles in Masonic Membership in New York State and in Ionic Lodge, by Joseph E. Appel 295
The 7.6-Year Cycle in Barometric Pressure in New York City, 1873--1955 297

HOW IT CAME OUT

A Projection of Five Cycles in Copper Prices 307
THE 1956 POSTSCRIPT TO *Cycles--The Science of Prediction* Part X: The 8-Year Cycle--Concluded 309
LETTERS 314
THE MODIFIED GEISINGER INDICATOR OF INDUSTRIAL PRODUCTION . . . 316
GLOSSARY 318

SUPPLEMENT

Foundation Reprint No. 38, A List of Rhythms, by Edward R. Dewey . 300

THE FOUNDATION FOR THE STUDY OF CYCLES

The Foundation is a not-for-profit corporation, the board of directors of which consists the following committee

UNITED STATES OF AMERICA

Copley Amory, Chairman Emeritus

Charles Greeley Abbot
Secretary, Retired
Smithsonian Institution

Harold Elmer Anthony
Chairman and Curator
Department of Mammals
American Museum of Natural History

George Baekeland, Chairman of the Committee of the Foundation
The Bakelite Corporation

Harold Gardiner Bowen
Vice Admiral, U.S. Navy, Retired

Verne Burnett
Partner
Verne Burnett Associate

Hon. W. Cameron Forbes
Member, Board of Trustees
Carnegie Institution of Washington;
Life Member of the Corporation,
Massachusetts Institute of Technology

Alan Gregg
Vice President, Retired
Rockefeller Foundation

Webster N. Jones
Vice President, Retired
Carnegie Institute of Technology

Charles B. Lansing
Chairman of the Board of Trustees
Western Reserve University

Daniel Trembly MacDougal
Director, Retired
Department of Botanical Research and
Laboratory of Plant Physiology,
Carnegie Institution of Washington

John Quincy Stewart
Professor of Astronomical Physics
Princeton University

CANADA

Hon. Charles Camsell
Commissioner, Retired
Northwest Territories

Frank Cyril James
Principal and Vice-Chancellor
McGill University

GREAT BRITAIN

Sir Patrick Ashley Cooper
Governor
Hudson's Bay Company

Julian Sorell Huxley
Former Director General
United Nations Educational, Scientific and Cultural Organizations

Edward R. Dewey, Director

Cycles IS PUBLISHED BY THE FOUNDATION FOR THE STUDY OF CYCLES MONTHLY AT THE FOUNDATION'S OFFICE AT EAST BRADY, PENNSYLVANIA. SUBSCRIPTION RATE $10.00 A YEAR. ENTERED AS SECOND CLASS MATTER AT THE POST OFFICE AT EAST BRADY, PENNSYLVANIA, WITH ADDITIONAL ENTRY AT ANN ARBOR, MICHIGAN. PUBLICATION OFFICE, 680 WEST END AVENUE, NEW YORK 25, NEW YORK. COPYRIGHT 1956, FOUNDATION FOR THE STUDY OF CYCLES.

cycles

The official Bulletin of the Foundation for the Study of Cycles

VOLUME VII NUMBER 11 NOVEMBER 1956

THE DIRECTOR'S LETTER

Dear Member:

A List of Rhythms

In 1946, when Life magazine was planning an article on cycles, the editors asked me to give them a list of all the rhythms that I had ever heard about.

To accomodate them I called in my secretary and spent an afternoon dictating. The results of that afternoon's work are printed as a supplement to this issue on pages 299--308.

I tell you all this to indicate that the supplement is a very casual piece of work, undocumented, and taken in some instances from popular rather than from scientific publications. The list is neither complete nor authoritative. Many of the rhythms are controversial. And some, as far as I am concerned, are completely unsubstantiated.

Nevertheless, everyone who saw the list urged me to reproduce it for general distribution to our members. People felt that even though the list might be at fault in particular instances, it gave a better notion of the scope of the subject of cycles than anything else they had seen.

I finally yielded to this pressure and, in 1949, I published it.

I am now reprinting it for the benefit of our newer members. I hope that they will find it as interesting as our earlier members seemed to.

As you will see when you read it, it is divided into two sections. The first gives some examples of certain well-known cycles such as the day, the month, the year. The second is arranged by science.

Stock Market Research

My audit of the stock market work of 1944 is proceeding nicely. I am quite pleased with the results.

We are getting a great deal of light on the behavior of the Combined Stock Price Index, which starts in 1871, by also studying the Rail Stock Price Index which starts in 1831, 40 years earlier. That is, when rails and the combined index have the same cycle, 1871--1955, we feel safe in studying that particular cycle in rails, 1831--1955, and then applying what we learn from studying rails to the shorter combined index.

This month I'm reporting further in regard to this work; next month I'll tell you more.

Technical

If you are interested in technical matters you may wish to read an article by me called "The 9.18-Year Cycle in Railroad Stock Prices, 1831--1955, and the Techniques Used in its Definitization." This article was published in the July 1956 issue of the *Journal of Cycle Research* The article is 32 pages long. It gives *all* the work papers and *all* the calculations. Price $1. Better yet, subscribe to the *Journal;* price $4 a year.

The Cyclopedia of Cycles

Apologies for the fine print of page 1 of the Cyclopedia of Cycles, published in the October report. The printer made a mistake and reduced the copy about a half more than we told him to.

A New Approach Needed

No one can look at the copper chart (page 308) in the *How It Came Out* section without being impressed by the precision with which copper prices have conformed, in *timing,* to a cycle forecast made early in 1954. On the other hand no one can fail to be even more impressed by the dismal failure of the forecast in respect to *strength.* Of course part of the failure is due to the fact that the particular forecast printed did not include any allowance for trend or inflation. Moreover it is also true that in buying or selling the important thing is timing. If you know the *time* of the low and the *time* of the high, the profits will take care of themselves. Nevertheless, from the standpoint of cycle study one could wish that the strength of the synthesis were much closer to reality than it turned out to be.

Why does a cycle forecast generally show much less strength than it should?

The answer lies in the fact that the successive waves are not of uniform length, but the cycle analyst must pretend that they are. For example, the coldest months on six consecutive years might be January, March, March, February, January, February. On the *average,* February would be coldest. However, the average temperature for February for all six years would give no idea of how cold a winter might really get. So it is when you project an average cycle.

We now try to explain the irregularities in terms of other cycles--and there *are* other cycles. But if we could discover the law of irregularities--if there is such a law--it would be not only vastly simpler but would greatly improve cycle forecasts.

I am reminded of the old days when people thought the earth was the center of the universe and that the sun and all the planets moved around the earth in huge circular cycles. They *had* to move in circles, according to the thinking of the time, because circles were perfect and nothing less than perfection would do for anything celestial.

On the other hand observations showed that, viewed from the earth, the planets did not move perfectly. They moved irregularly. In fact they sometimes even moved backward.

To explain these irregularities the ancients imagined that the planets moved in little circles superimposed upon big ones. The little circles were called epicycles.

As observation became more and more exact, more and more epicycles needed to be invented.

The system worked after a fashion and prediction could be made. However the setup was horribly complicated. It was not until Copernicus came along (about 1500) and put the sun at the center of the solar system and Kepler (about 1600) showed that planets moved in elipses, that astronomy got simple, accurate, and fully dependable.

In cycle study we have much the same situation. We assume that the cyclic forces are regular, partly because they "ought" to be regular and partly because we don't know how to deal with them unless they are regular. Then we try to account for the irregularities by postulating other cycles. As I said above, there *are* other cycles, and there are randoms too, but over and above this, if we only knew enough, some of the irregularities of the cycles might be predicted too.

If we only knew enough! What we need is a Copernicus and a Kepler in cycle study!

Cordially yours,

Edward R. Dewey

Edward R. Dewey
Director

THE 7.94 AND 8.39-YEAR CYCLES IN RAILROAD STOCK PRICES, 1831—1955

IN 1951 we made a multiple harmonic analysis of 120 years of railroad stock prices, 1831—1950. This analysis suggested 39 different cycles possibly present in these figures. The cycles were all 3.9 years long or longer. (We did not investigate cycles shorter than 3.9 years.) In the eight-year range three lengths were suggested, viz: 7.80, 7.95, and 8.33 years.

A multiple harmonic analysis is a high falutin name for trial and error. In an analysis of this sort, you say in effect, "*If* there is a cycle *4.0* years long, how strong is it?" Then you say, "*If* there is a cycle *4.05* years long, how strong is it," Then you say, "*If* there is a cycle *4.10* years long, how strong it is?" You do this for about 350 different lengths. With paper, pencil, and calculating machine, the job takes one person about 10 weeks, full time. The lengths that show the greatest strength are the lengths where it is most profitable to look for cycles.

An 8 1/6-Year Cycle in the Combined Stock Price Index

You doubtless remember that I told you that there is an 8 1/6-year cycle in the *combined* stock price index, 1871--1955, (*Cycles,* Vol. VII, No. 10, October 1956, p. 265.) The multiple harmonic analysis showed no such length for *rail* stock prices. How can this seeming inconsistency be explained?

Suppose there are 7.95- and 8.33-year cycles present in rail stock prices. When these two cycles are in step they would reinforce each other and appear to be a cycle with a length about half way between 7.95 and 8.33—about 8 1/7 years long. When the cycles are out of step they would offset each other and disappear. When they got back in step again an 8 1/7-year cycle would reappear. Each reappearance of the 8 1/7-year cycle would be out of step with the reappearance before and the reappearance after.

An 8 1/6-Year Reversing Cycle in Rails

Now this sort of thing is exactly what we find in rail stock prices. In rail stock prices 1871—1955 there *is* a cycle about 8 1/6 years long just as we find in the combined stock price series. Then, as you go back it fades out. Then, as you go back still further it reappears. Moreover, when it reappears it is out of step with the 8 1/6-year cycle 1871--1955, just as it "should" be.

Everything now fits together except that the harmonic analysis suggested a 8 1/7-year length; the later work a length of 8 1/6 years. Which is right?

Multiple harmonic analysis cannot be counted on to give the true length of the constituent cycles. The lengths it gives are only approximate. Let us try better ways.

The Analysis

We start with the rail stock price index itself. (See *Journal of Cycle Research*, Vol. 5, No. 3, July 1956, page 63 for actual values.) This index is plotted as Curve A of Fig. 1 on pages 290 and 291.

We then computed a 9-year moving average trend, estimating the first four and last four values (Curve B of Fig. 1).

We adjusted for the trend. That is, we computed the percentage that each value of Curve A is above or below the corresponding value of Curve B. These percentages are plotted in Fig. 1 as Curve C. It is as if Curve B had been pulled straight.

I have told you about the 9.18-year cycle in the rail stock price index (*Cycles*

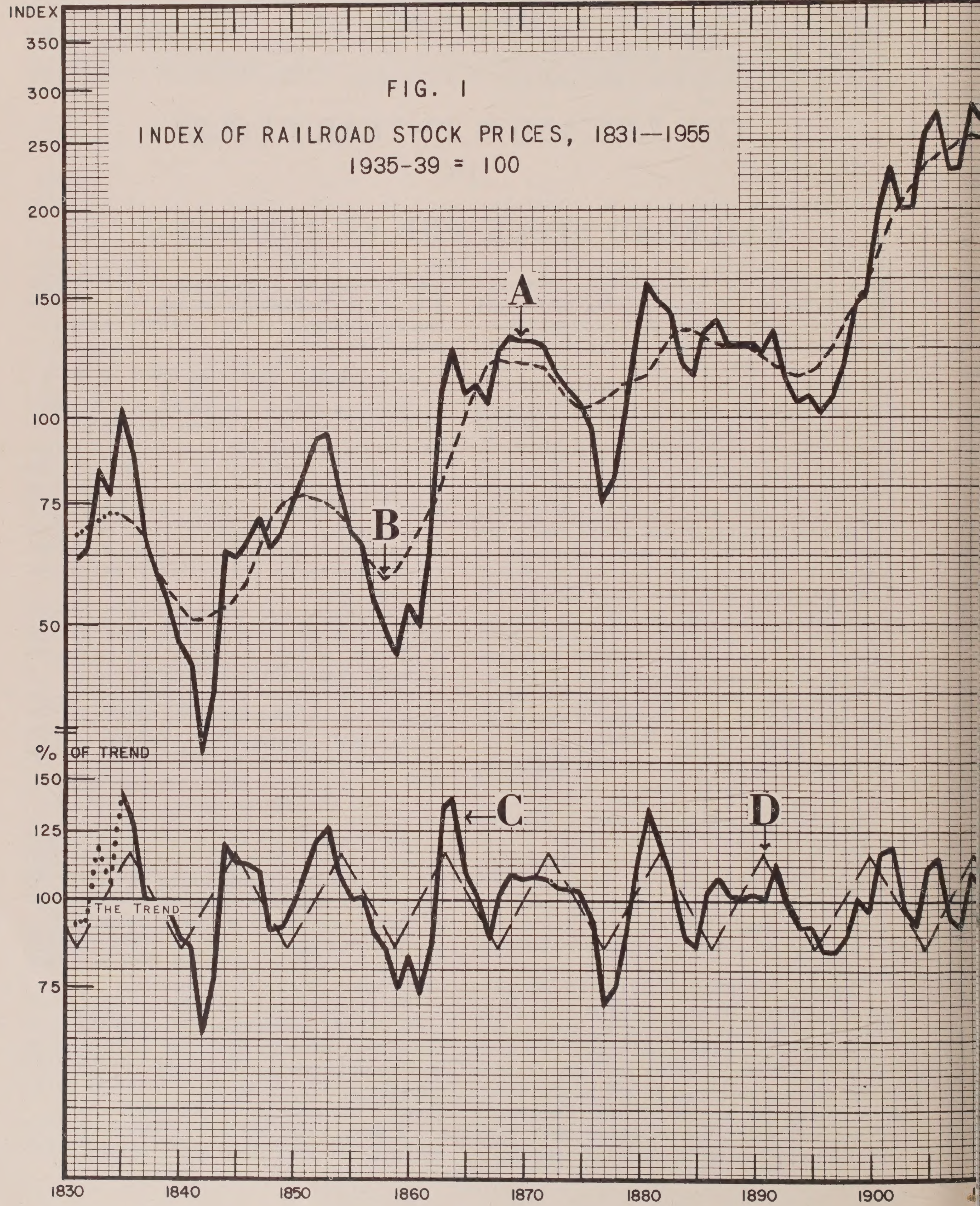


FIG. I

INDEX OF RAILROAD STOCK PRICES, 1831—1955
1935-39 = 100

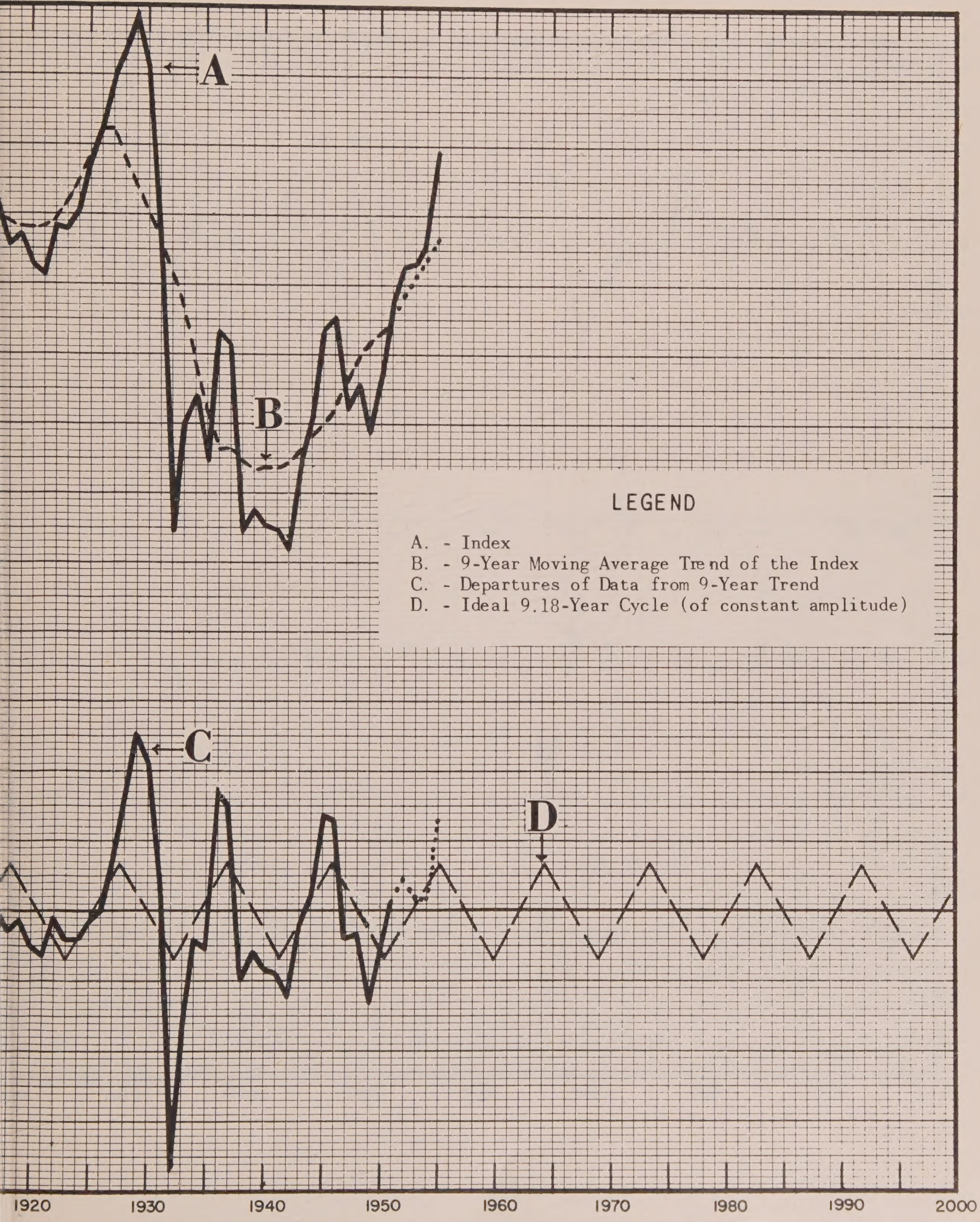
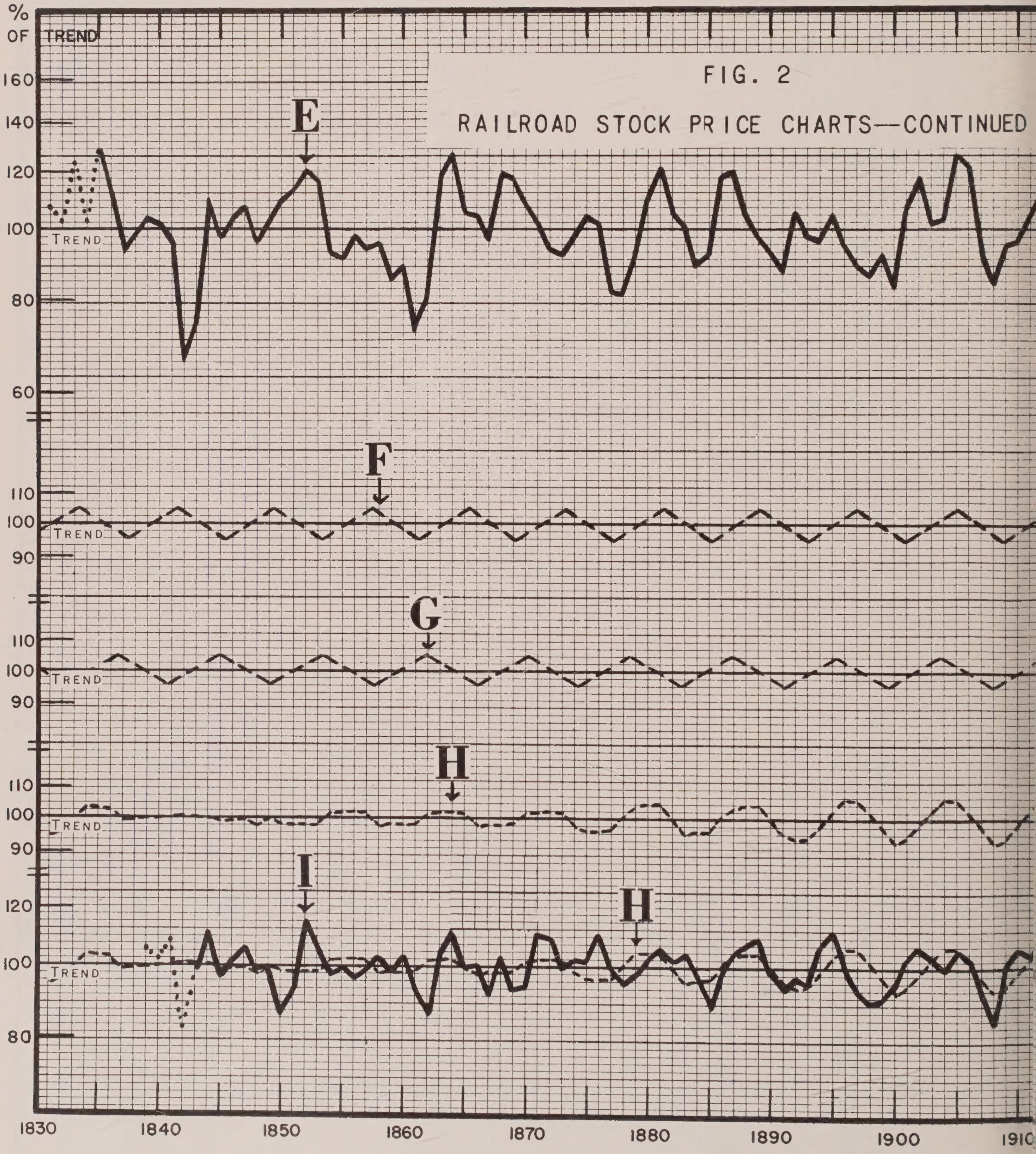
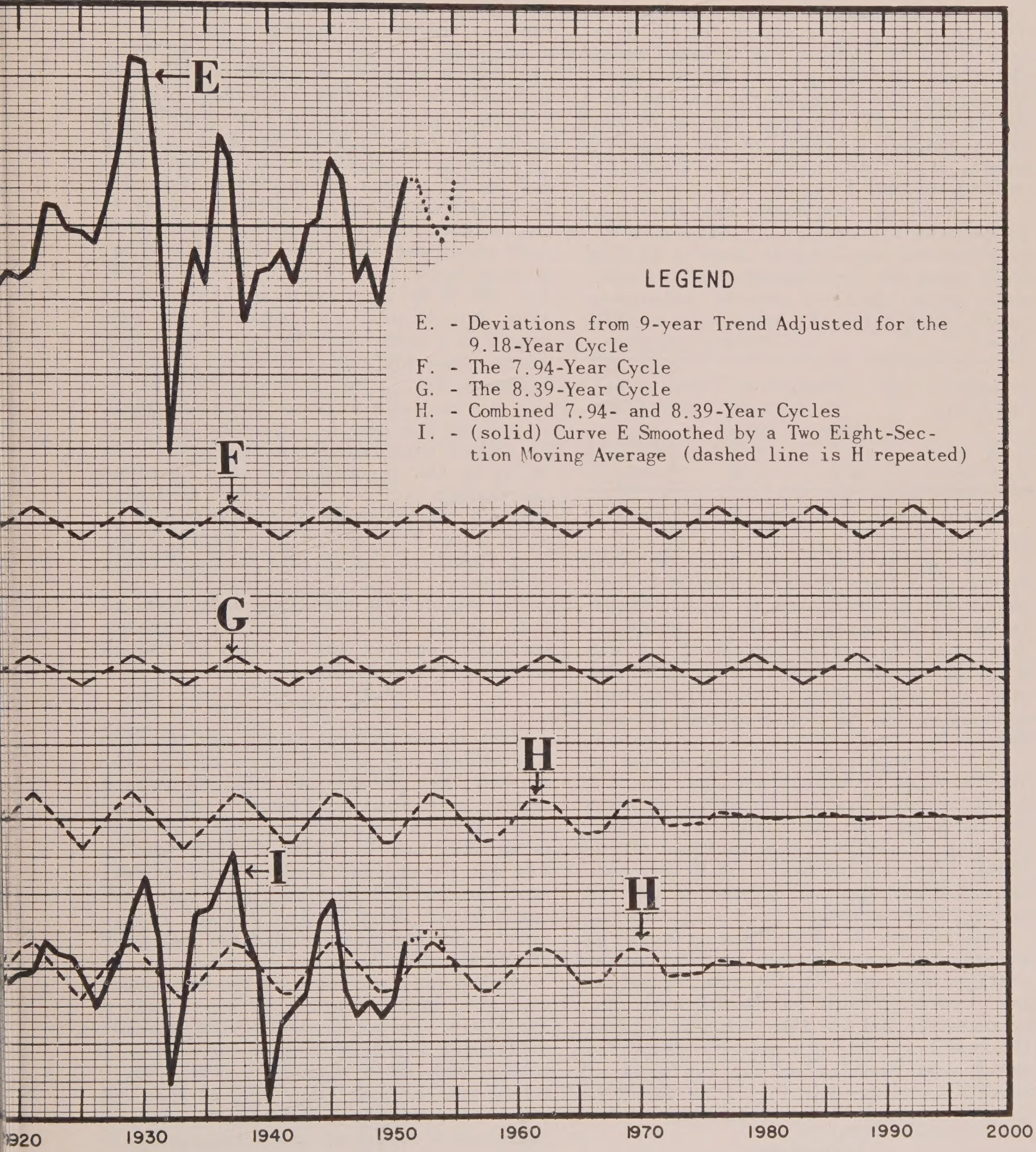

A
B
C
D
LEGEND
A. - Index
B. - 9-Year Moving Average Trend of the Index
C. - Departures of Data from 9-Year Trend
D. - Ideal 9.18-Year Cycle (of constant amplitude)
1920
1930
1940
1950
1960
1970
1980
1990
2000

FIG. 2

RAILROAD STOCK PRICE CHARTS—CONTINUED




E
LEGEND
E. - Deviations from 9-year Trend Adjusted for the 9.18-Year Cycle
F. - The 7.94-Year Cycle
G. - The 8.39-Year Cycle
H. - Combined 7.94- and 8.39-Year Cycles
I. - (solid) Curve E Smoothed by a Two Eight-Section Moving Average (dashed line is H repeated)
F
G
H
I
H
920
1930
1940
1950
1960
1970
1980
1990
2000

Vol. VII, No. 6, June 1956, p. 157). This cycle is diagrammed in Fig. 1 as Curve D. It will help us if we adjust for the 9.18-year cycle. By "adjust for" I mean "remove the effect of." The process is the same as adjusting for seasonal variation in a series of monthly figures. The percentages above and below trend, ex the 9.18-year cycle, are shown in Fig. 2 on pages 292 and 293 as Curve E.

To find our two component curves we proceed by the method of successive approximation, arriving at lengths of 7.94 and 8.39 as the best estimates we can make, using annual data and present techniques. Cycles have strengths and timing as follows:

Length of Cycle	Strenth as % of Trend		Time of Latest Crest
	Above	Below	
7.94 years	4.2	4.1	1953.09
8.39 years	4.0	3.8	1954.59

These cycles are diagrammed in Fig. 2 as Curves F and G.

The synthesis of curves F & G is shown in Fig. 2 as Curve H. Curve H could be compared with Curve E, but it will probably be better to compare it with a two-8-year section moving average of Curve E, as such a moving average has little or no effect upon any real cycles in the neighborhood of 8 years, but does tend to minimize randoms.

A two-8-year section moving average is very simple. It merely averages the 1st 8-year section (values for 1871-1878) and the 2nd 8-year section (values 1879-1886), plotting in the 2nd cycle position (1879-1886); then the 2nd and third 8-year sections are averaged and plotted in the 3rd cycle position, etc.

Another way of describing it would be to say that a two-8-year section moving average, averages the 1st and 9th values and plots the result in the 9th position, averages the 2nd and 10th values and plots the result in the 10th position, etc. The two-8-year section moving averages of Curve E is plotted in Fig. 2 as Curve I. Curve H is repeated for comparison.

Evaluation

Are there real cycles of these lengths operating in the stock market? Or do our cycles merely serve to *describe* some random oscillations? At the present time no one can say, one way or the other, for sure.

Arguing *for* the idea of real cycles of these wave lengths, we could say (1) they do describe what has happened; (2) the 7.94-year cycle is, for all practical purposes, the same length as has been found in 16 other kinds of figures of both natural and social science. (See *Cycles*, Vol. VII No. 10, October 1956, p. 271). Moreover in rail stock prices the 7.94-year cycle comes just about the same time as in the other places where this cycle has been found; (3) the 8.39-year cycle on its part is also, for all practical purposes, the same length as a cycle that has been found elsewhere. (See for example *Journal of Cycle Research*, Vol. 3, No. 1, Winter 1954, p. 3) and it also comes at about the same time.

Against the idea of significance it can be argued that before we should believe fully in the significance of a compound (reversing) cycle of this sort, the fading out and reappearance should repeat time after time. This series of figures is not long enough to enable this compound cycle to do so.

On the whole I think the best guess is that these cycles are worthy of tentative acceptance pending further study of them in longer series of figures.

The Future

What of the future? As you can see from the chart, the combination of the two cycles last crested in 1953.84 with a strength of about 5.2% above trend. This means that rail stock prices are now 4.7% below what they would be if these cycles did not exist, and that in 1961.0 rail stock prices will be 4.3% higher than they would be if these cycles did not exist. (Don't get confused. I did *not* say 4.3% higher than *now.)*

As you can see, these cycles are important when added to other cycles to make a synthesis. They can make a considerable difference in the timing of buy and sell points, and, in my opinion, are well worth taking into account. They tell us that, if our cycles continue, the decline we may expect as a result of the 9.18-year cycle will be softened by the upward force of these 8-year cycles by about 9% (4.7% + 4.3%).

E.R.D.

Trends and Cycles in Masonic Membership In New York State and in Ionic Lodge[*]

By Joseph E. Appel

Synopsis—*Masonry has grown tremendously in New York in the last 100 years and has attained a position of importance. An analysis shows that this growth must not be taken for granted. Masonry's strength must lie in its resiliency and flexibility. The Craft's achievements in the past were made possible by its ability to move with the times. This fact must not be overlooked in the possibly difficult future that we and the rest of the world must face.*

I

The Number of Masons in New York grew from a low of 19,316 in 1856 to a high of 346,413 in 1929. Ionic Lodge in New York City grew from a low of 63 in 1889 to 926 in 1929. These great advances are pictured in Figure 1, which shows the numerical changes in membership up to the end of 1951.

A decline which began in 1930 did not end until 1942 for both New York State and Ionic Lodge. Since then membership has steadily advanced, retracing part of the preceding decline, but it has not yet reached its former high level.

II

About 60 per cent of the loss in membership in New York during the long depression from 1929 to 1942 has been made up, and according to the information in Figure 1, the historical growth of Masonry in New York has been resumed. The solid line is again approaching its former peak. However, what does other analysis show? During the last 100 years New York State and New York City populations also have grown. What was the position of Masonry relative to this growth in population? How much of Masonry's growth was due only to the natural growth in population?

Figure 2 shows the number of Masons for each 100,000 of population in New York State, and the membership in Ionic Lodge for each 100,000 of population in New York City. In addition these figures have been charted on a scale which shows the *percentage* changes in membership per 100,000 of population. Figure 1 shows only the numerical changes.

Study of Figure 2 shows that there have been two big periods of relative growth for Masonry in New York State. The first was from 1856 to 1869. The second was from about 1900 to 1928. Ionic Lodge in New York City has had one big period of relative growth, from 1899 to 1928.

It is seen that the rebound from the low of 1942 has been relatively mild, and the line in Figure 2 in recent years has assumed a flat, or horizontal position. For New York the line is nearer the top of 1874, rather than the more recent top of 1927. For Ionic Lodge, the present level is far below its two former high points.

Stopped for Present

The indications are that membership growth for New York Masonry, relative to population, has stopped for the present at a level about 28 per cent below the peak. This is borne out when we look at the latest actual numerical increases in membership, which were as follows:

(see next page)

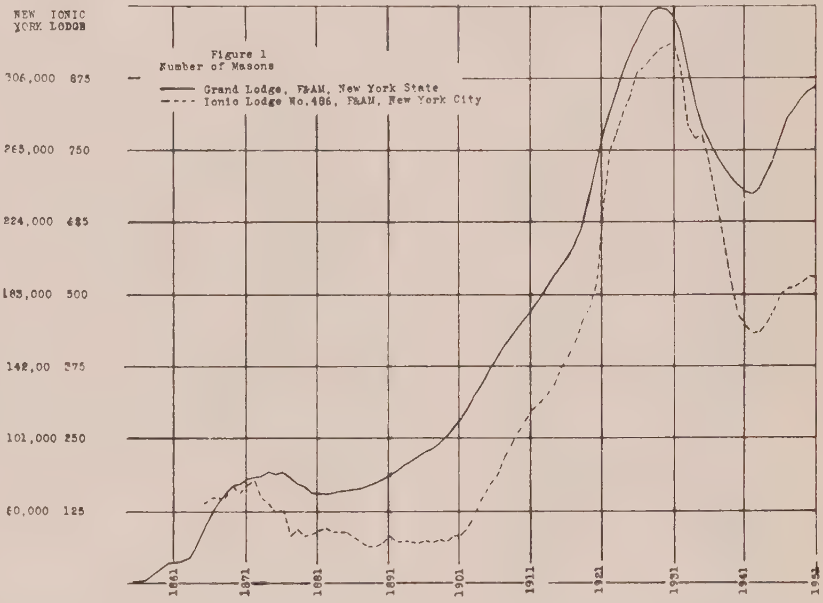


Figure 1
Number of Masons

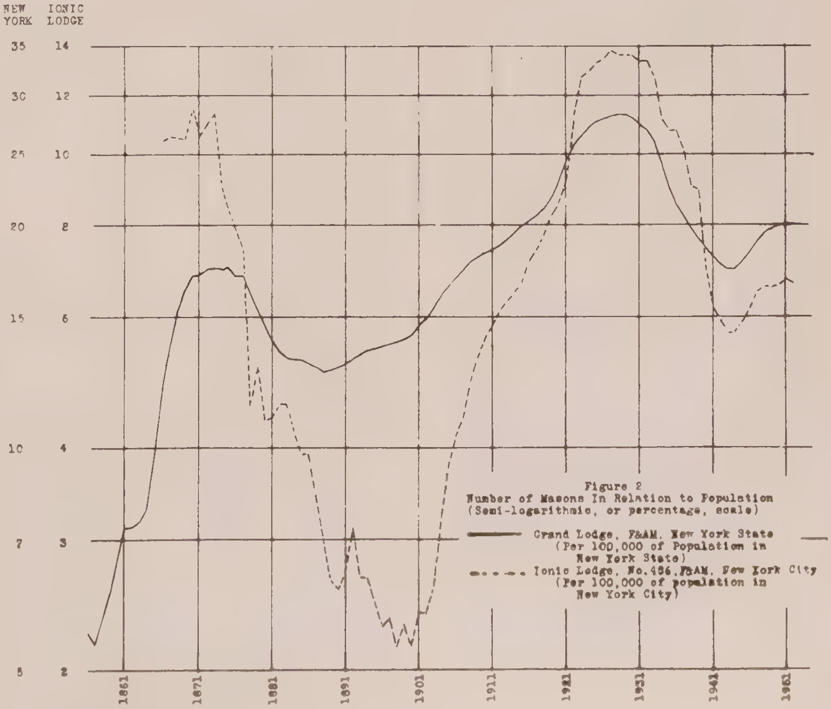


Figure 2
Number of Masons In Relation to Population
(Semi-logarithmic, or percentage, scale)

---

[*] REPRINTED FROM MASONIC OUTLOOK, FEBRUARY, 1953. PP. 13 & 14.

Trends and Cycles in Membership

(concluded from page 295)

Year	*Increase*
1948	6,621
1949	5,322
1950	3,904
1951	2,516

These figures look more unfavorable in the light that they follow a post-war upsurge, and the decline may have another significance, which will be explained in the next section.

III

Each one of our country's big wars brought about an increase in interest in Masonry, so that membership increased importantly at those times, far more than for the periods immediately preceding them. The changes were as follows:

CIVIL WAR

*Year**	*Increase*
1864	7,160
1865	9,720
1866	7,244
1867	7,199
1868	5,690
1869	3,746

WORLD WAR I

Year	*Increase*
1919	14,117
1920	19,388
1921	18,352
1922	13,960
1923	12,440
1924	12,236

WORLD WAR II

Year	*Increase*
1944	7,570
1945	9,070
1946	12,545
1947	10,705
1948	6,621
1949	5,322

*** Years ended May or June 1. Other dates are for years ended December 31**

At the beginning of World War II the number of Masons in New York was about 10 to 12 per cent higher than at the beginning of World War I, but the increase after World War I was far greater than the increase after World War II.

Membership of Masons in New York State at the beginning of World War II was about eight times the number at the beginning of the War Between the States (Civil War), yet the recent increase was only about 25 per cent more than it was 80 years before.

After the Civil War and World War I there was a serious decline in membership in New York, as shown in Figure 1 and Figure 2. These declines followed immediately after the record war increases tabulated at the beginning of this section, and after new historical peaks in membership had been reached.

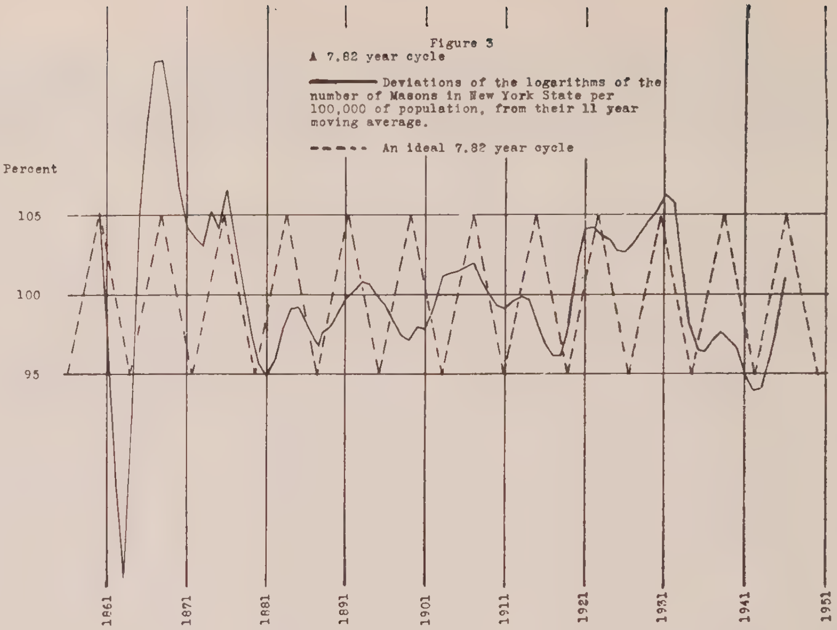


Figure 3
A 7.82 year cycle

If precedent is accepted as a guide, membership of Masons in New York has already passed through the stage of a big war increase, and is now approaching a post-war decline. This is further borne out by the decline in membership increases in recent years as tabulated at the end of the preceding Section II and as indicated by the recent flattening of the heavy line in Figure 2. The former post-war declines came after new highs had been established, but the approaching decline, if it happens, is starting from a lower level.

IV

The peaks in membership of Masons in New York, illustrated in Figures 1 and 2, are 54 years apart. This length coincides with the length of cycles found by Kondratieff* in different economic time series in a few countries. If this is true, then the bottom of this cycle in membership of Masons in New York has been reached, and the recent depressed tendencies will be replaced by an upward trend.

If so, this would be contrary to the weight of the data already presented here. There has been only one such apparent cycle in the statistics of membership, and the peaks may have been the peaks of two different cycles of different lengths.

A secondary trend in membership of Masons in New York is shown in Figure 3. The solid line shows the *percentage* fluctuations of membership around the primary trend of the data depicted in Figure 2. The dotted line is an ideal, regular 7.82 year cycle.

Making allowance for the distortions of other cycles, exact timing is shown in some instances, and close timing in all other instances. Altogether, this cycle has repeated itself 12 times.

Secondary trends, like the 7.82 year cycle, do not have any casually observed effect on any strong long-term movements such as have affected membership of Masons in New York in the past. They have affected the tempo, however, showing up as bigger or smaller annual increases. The analysis of these annual increases is not included herein, but part of these annual changes have been tabulated in Sections II and III.

Conclusion

Masonry in the State of New York appears to have reached a top in its growth. This is comparable with the maturity of the human being, and it has also been observed by economists in the growth of businesses and other organizations.

This does not mean a fatalistic acceptance of eventual age and decay of Masonry. History has proven many times that a new birth and growth has been begun by countries or enterprises upon the application of different dynamic principles, or the recognition of new factors.

The Grand Lodge of the State of New York has already recognized the many tremendous social and economic changes that have occurred in the last 50 years and has taken steps to meet them. Growth is assured by these forward-looking policies, embracing charities and benevolences over and above its own memberships, and outside its own Lodge rooms. This program has been adopted to keep Masonry young, healthy, and growing.

*** See *The Long Waves in Economic Life* by N. D. Kondratieff, in the Review of Economic Statistics, November, 1935, pp. 105-115, translated by W. F. Stolper.**

THE 7.6-YEAR CYCLE IN BAROMETRIC PRESSURE AT NEW YORK CITY,

1873–1955

IN my report for May 1953 I told you of a cycle in barometric pressure in New York City, 1873—1952. I said that this cycle was "probably about 7.8 years" long.

An audit of this work, using three additional years of data and some improved techniques, suggests that the length of the perfectly regular cycle which best fits all the various fluctuations is somewhat shorter than previously estimated. I would now put the length of the cycle at probably about 7.6 years.

There are two reasons why I am not more definite. One, the series of figures is short, relative to the length of the cycle; two, the non-cyclic fluctuations are great, relative to the strength of the cycle. If figures have either of these two characteristics it is unwise to try to be too exact in definitizing the cycle.

The raw annual averages of pressure are charted in Fig. 1 on the page next following. The non-cyclic randoms are so strong that the cycle cannot easily be detected by inspection.

Fig. 2 shows the values in Fig. 1 "smoothed." The smoothing was effected by a 3-year moving average. That is, the values 1873-75 in Fig. 1 were averaged and the average plotted in Fig. 2 as the value for 1874; then the values 1874-76 in Fig. 1 were averaged and the average plotted in Fig. 2 as the value for 1875; and so on. This process minimizes randoms by giving big randoms and little randoms a chance to offset each other; it has but moderate (3/7.6) effect upon the strength of the cycle; no effect upon its length.

The 7.6-year cycle in barometric pressure at New York City has a typical strength of .010 inches of mercury above trend at time of crest; an equal amount below trend at time of trough. The cycle crests ideally at 1951.0 and every 7.6 years from that date.

This cycle in these figures becomes more interesting when I tell you that cycles of about the same length have been found in other phenomena. H. H. Clayton found a 7.54-year cycle (probably the same cycle) in barometric pressure all the way from latitudes above 60° in Siberia and Iceland to the tropics in Calcutta. He also found it very clearly in sunspots. Gerry Lane's comprehensive cycle analysis of 200 years of sunspot numbers (see *Journal of Cycle Research*, Vol. 3, No. 1, Winter, 1954) also disclosed a cycle 7.6 years long present on the average in these figures. My own comprehensive analysis of pig iron prices (see *Cycles* for June 1952, pages 207-9) shows a cycle of this length present on the average in pig iron prices 1784--1950, a span of 167 years. The same length has been found in the solar constant--the amount of heat received on earth from the sun.

The 7.6-year cycle in sunspots is upside down in relation to barometric pressure at New York City. When the 7.6-year cycle of sunspots is high the 7.6-year cycle of barometric pressure at New York City is low, and vice versa.

The 7.6-year cycle in barometric pressure has been repeated (1) enough times, (2) with enough regularity, (3) in enough different sorts of figures so that it cannot easily be the result of chance.

E.R.D.

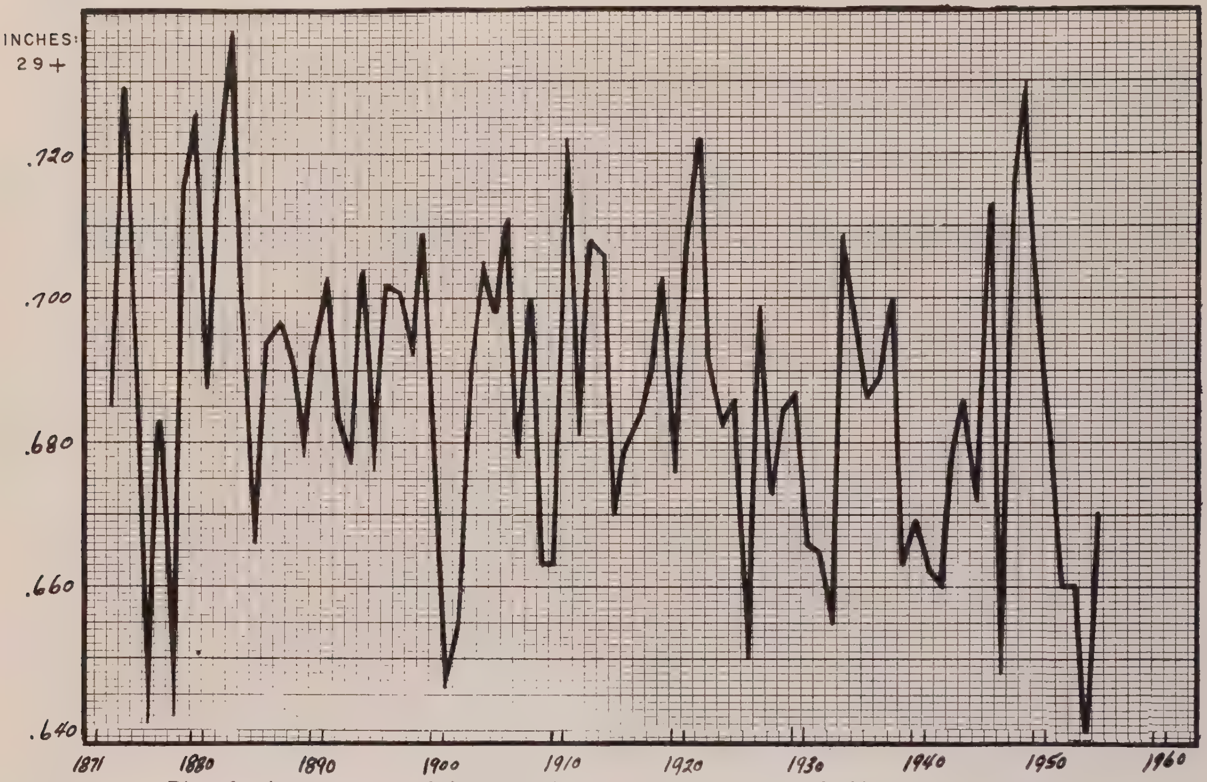


Fig. 1. Average annual barometric pressure at New York City, 1873--1955.

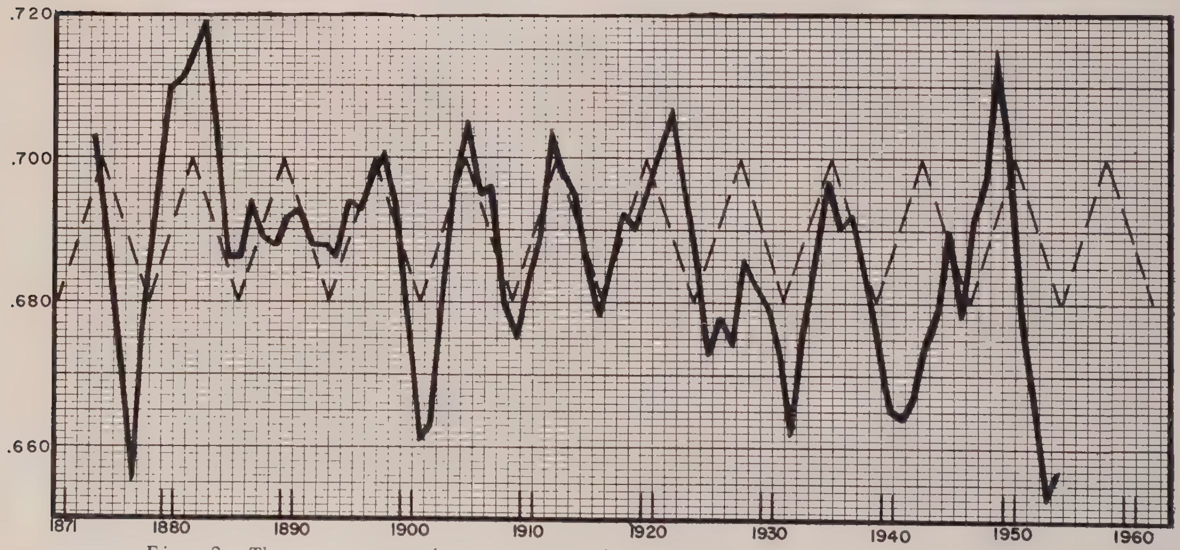


Fig. 2. Three year moving average of barometric pressure at New York City, 1873--1955. There are no plottings for 1873 or 1955 because a three year moving average loses a year at each end of the series. A perfectly regular 7.6-year cycle has been added by means of a broken zigzag line.

A LIST OF RHYTHMS

Variously Determined and/or Alleged

Compiled by

EDWARD R. DEWEY

Reprint No.38

FOUNDATION FOR THE STUDY OF CYCLES

1949

A LIST OF RHYTHMS*

Section I

This section deals with several well-known rhythms of general interest, and gives examples of phenomena alleged to correspond to each of them.

THE DAY

The day is a 24-hour alternation of light and darkness. It is probably the world's best known example of a periodicity. Many things vary in a daily cycle. For example: changes in the intensity of light, variation in temperature, and variation in activity on the part of mammals, insects, birds, fish, and reptiles. These variations are well known, but certain other daily rhythms are not so generally recognized. For example:

PLANTS

1 - Electrical conductivity of sap of plants. Maximum in the forenoon.
2 - Assimilating activity of plants. Maximum in the morning and forenoon.
3 - Growth in the individual organs of plants.
  a) Roots - maximum between 9 A.M. and 11 A.M.
  b) Sprouts - between 3 A.M. and 5 A.M.
  c) Cell division of numerous algae occurs only at night.
  d) Height of trees - maximum growth between noon and 6 P.M.
4 - Opening and closing of the leaves and blossums of many plants. (Linnaeus constructed a timepiece of flowers. By seeing which flowers were open, he could tell the time of day.)
5 - Production of nectar. In numerous honey flowers the maximun is from early morning until about 9 A.M.
6 - Contents of aromatic substances, etheric oils, and alkaloids in plants. (Tobacco has its maximum of nicotine during the night. The etheric oils such as peppermint and lavender obtain a maximum between 8 A.M. and 10 A.M.
7 - Growth substances of plants. Maximum concentration from 4 to 6 A.M.

ANIMALS

1 - Pulse and respiration have a maximum until towards morning. This holds true even if a person remains awake throughout the night.
2 - Temperature (in the human body) has maximum between 5 P.M. and 8 P.M., but varies with the individual.
3 - Oxygen consumption has maximum at 5 P.M.
4 - Content of white blood corpuscles has maximum at 4 P.M. and 8 P.M.
5 - Blood sugar content has maximum at 2 A.M. to 4 A.M.
6 - Viscosity of the Leucocytes - maximum 7 P.M.
7 - Storing of glycogen in the liver - between 12 midnight and 4 A.M.
8 - Evacuation of salt and water has a maximum between 7 A.M. and 10 A.M.
9 - Adrenalin content of suprarenal gland has a maximum between 2 A.M. and 4 A.M.
10 - Birth shows a daily rhythm.
11 - Death - maximum between 4 A.M. and 6 A.M.
12 - Playfulness.

MISCELLANEOUS

1 - Barometric pressure.
2 - Terrestrial magnetism.
3 - Electric power production.
4 - Gas consumption
5 - Economic activity of many other sorts.
6 - Sexual desire.
7 - Aurora Borealis.

***Note:**— The existence of many of the rhythms listed is controversial. Many of the lengths have not been determined accurately. The list should be considered in the main as a collection of hints to be verified or denied.

THE YEAR

The variation of the year, called seasonal variation, next to the day, is probably the most important and best known rhythm. We are all familiar with the change of temperature, of plant and animal life, and of business activities which come with the change of the seasons, but there are other annual rhythms that are less well known. For instance:

1 - Criminology - there is an increased number of crimes of violence in mid-summer.

2 - Mental disorders.

3 - Rock strata. The sediments washed down in the spring have a different characteristic from sediment washed down in the fall. Consequently sedimentary rock is often laid down in layers called varves (about 1/16 of an inch thick) that represent an annual rhythm.

4 - Acidity of arable land is at a maximum in the winter.

5 - Humus content and nitrogen content of soil.

6 - Solubility of phosphoric acid in forest soil has its maximum in the autumn and winter.

7 - Activity of bacteria in soil has a maximum in the late spring and early autumn

8 - Tree rings - varying content of certain substance in the individual organs and parts of wood. (The new wood formed during winter has very different characteristics from the wood formed during the summer. This gives rise to alternate "rings", each pair of which represents the growth of one year.)

9 - Content of aromatic substances, active substances, etheric oils, and alkaloids.

10 - Mental activity - established by the withdrawing of books from libraries, students grades, number of patent applications and amendments to patent applications filed-show a maximum in the spring.

11 - Mental characteristics of children conceived at various seasons of the year. (Professor Huntington of Yale.)

12 - Many diseases -
    winter maximum - example pneumonia
    summer maximum - example disentary

13 - Births.
14 - Bird migration.

THE TIDAL PERIOD

(About 12½ hours)

Marine biology furnishes a large number of examples of ways in which organisms have adopted their way of life to the ebb and flow of the tides. Many of these are most ingenious and interesting. In addition to the ebb and flow of the waters, there are similar fluctuations in the atmosphere. Also; it is alleged:

1 - Fish - even in inland waters fish bite better at certain phases of the tide.

2 - Birth of cattle - show a tidal rhythm with births taking place chiefly with the incoming tide. The same thing is true in certain places for birth of human beings.

THE LUNAR MONTH

Rhythms corresponding to the lunar month, approximately 28 days, abound. For instance, there is a rhythm of this length alleged in :-

1 - Thunderstorms.
2 - Menstrual cycle.
3 - Northern lights.
4 - Sap in trees.
5 - Plant growth.
6 - Stock market prices (very, very minor and unimportant).
7 - Change of shell of certain crustacia.
8 - Sex of children born (males in the waxing phase and females during the waning phase).
9 - Amorousness of women (- Two waves of 14 days each.)
10 - Palolo worms which swarm during the same moon phase (but only once each year)—similarly for the spawning of certain kinds of sea urchins.

THE WEEK

The social and economic consequences of our "day of rest" are too well known to require examples.

Section II

This section gives a list of disciplines, and examples of rhythms alleged in each.

PHYSICS

All these examples deal with phenomena having periods of less than a minute. These short waves of physics are generally described in terms of the *frequency*, that is, the number of waves per second or per some other interval of time. The other waves with which we have been dealing and with which we will deal are usually described in terms of their *period*, namely, the time required for one complete vibration. For the sake of consistency, the waves of physics will also herein be described in terms of their period.

1 - Secondary cosmic rays have a period from about $\frac{1}{10{,}000{,}000{,}000{,}000{,}000{,}000{,}000{,}000{,}000}$ second to about $\frac{1}{900{,}000{,}000{,}000{,}000{,}000{,}000{,}000}$ second.

2 - Gamma Rays have a period from about $\frac{1}{900{,}000{,}000{,}000{,}000{,}000{,}000{,}000}$ second to about $\frac{1}{3{,}000{,}000{,}000{,}000{,}000{,}000{,}000}$ second.

3 - X-rays have a period from about $\frac{1}{100{,}000{,}000{,}000{,}000{,}000{,}000{,}000}$ second to about $\frac{1}{50\ 000{,}000{,}000{,}000{,}000{,}000}$ second

4 - Ultra-violet waves have a period from about $\frac{1}{50{,}000{,}000{,}000{,}000{,}000{,}000}$ second to about $\frac{1}{1{,}000{,}000{,}000{,}000{,}000{,}000}$ second.

5 - Visible light waves have a period from about $\frac{1}{900{,}000{,}000{,}000{,}000{,}000}$ second to about $\frac{1}{600{,}000{,}000{,}000{,}000{,}000}$ second.

6 - Infra-red waves have a period from about $\frac{1}{600{,}000{,}000{,}000{,}000{,}000}$ second to about $\frac{1}{100{,}000{,}000{,}000{,}000}$ second.

7 - Radio waves have a period from about $\frac{1}{500{,}000{,}000{,}000}$ second to about $\frac{1}{10{,}000}$ second.

8 - Electric waves have a period from about $\frac{1}{50{,}000}$ second to 1 second.

9 - Sound waves have a period from about $\frac{1}{50{,}000}$ second to about $\frac{1}{14}$ second.

10 - Ocean waves - little, big.

MEDICINE

1 - Respiration period — about 2 seconds.

2 - Winking — about 4 or 5 seconds.

3 - Heart beats — about 1 second.

4 - Brain waves

Normal — about $\frac{1}{10}$ second.

Abnormal —as long as 1 second and as short as $\frac{1}{60}$ second.

(The rhythms in medicine listed above, together with the rhythms chosen from physics constitute all of the rhythms with periods of less than a minute.)

5 - Influenza — annual cycle and 3-year cycle.

6 - Pneumonia —annual cycle and 3-year cycle.

7 - Canine Rabies — 12-year cycle.

8 - Meningitis 10 to 12-year cycle.

9 - Diptheria —apparently a 6 to 7 year cycle.

10 - Measles — frequent 2 or 3 year cycle.

11 - Infantile Paralysis —irregular cyclic recurrence.

12 - Scarlet Fever — 6 or 7 year cycle.

13 - Plague in Bombay — 369 day cycle.

ASTRONOMY

Period of rotation of our galaxy 220,000,000 years.

1 - Eccentricity period given variously as 92,000 and 102,000 years.

2 - Obliquity of the elliptic precessional about 25,800 years.

3 - The heliocentric longitude of the perihelion given as 21,000 years.

4 - Number of sun spots: rhythms average

11.12 years, but many other rhythms in these numbers have been alleged.

5 - Variable Stars: over 2,500 have been discovered with periods of all lengths.

6 - Planets: sidereal revolutions of the planets are as follows:

Mercury	87.97 days
Venus	224.70 days
Earth	365.26 days
Mars	686.98 days
Jupiter	4,332.6 days
Saturn	10,759.2 days
Uranus	30,685.9 days
Neptune	60,187.6 days
Pluto	90,737.0 days

7 - The lunar month (from new moon to new moon) is 29 days, 12 hours, 44 minutes, 2.8 seconds.

8 - The axial rotations of the sun, moon, and planets are as follows:

	Days	Hours	Minutes	Seconds
Sun	25	9	7	12
Mercury	87	23	15	43
Venus	224	16	49	9
Earth		23	56	4
Moon	27	7	43	12
Mars		24	37	23
Jupiter		9	55	41
Saturn		10	14	24
Uranus		10	8	-
Neptune		15	40	-

9 - Comets return at various fixed periods.

	Periods in Years
Conati	2000.
Halley	2076.02
Tempel I	33.36
Wolf I	8.28
Schaumasse	7.95
Perrine	6.58
Tempel-Swift	5.68
Neujmin II	5.43
Gregg-Skjellerup	5.02

10 - Cosmic rays have a 27 day period.

11 - There are 2 lunar cycles of 2.85 years and 18.6 years.

12 - Many rhythms have been alleged in solar radiation including:

According to Abbot	According to Sterne
8-1/8 Months	6.26 Months
9.79 Months	8.38 Months
11.29 Months	9.68 Months
21.00 Months	10.29 Months
25-1/3 Months	11.15 Months
39-1/2 Months	13.13 Months
45-1/4 Months	15.20 Months
68.00 Months	17.45 Months
91.00 Months	20.4 Months
23.00 Years	24.8 Months
	40.8 Months
	67.6 Months

GEOLOGY

1 - Geological epochs - very roughly about 30,000,000 years.

2 - Geological periods - about 2,000,000 years.

3 - Certain repetitive characteristics of deposits are believed by some to represent the Ice-Age interval averaging 21,630 years.

4 - Readvances of the ice sheet during its last retreat up the Connecticut Valley - about 1,700 years.

5 - Deposits on the southern shore of Lake Erie as a result of the great storms - 90 year cycle.

6 - Certain alternations of certain sedimentary rock - about 50 years.

7 - Cycles in moraines - 67 years.

8 - Rhythms in thickness of rock strata laid down by sedimentary deposits corresponding to both the single and double sun spot cycle of 11 plus and about 23 years respectively. Many other lengths alleged for such deposits including 18-1/3 years, 33-1/3 years, etc.

9 - Old Faithful Geyser - 65 minutes.

HYDROLOGY

1 - Peruvian or the Humbolt current changes its direction every 10-13 years.

2 - Great Bear Lake water levels have a "3 hour tide" or schiche.

3 - Water levels of the Swiss Lakes have a 35-72 minute tide or schiche.

4 - Water level of Lake Mendota has 4, 6, 8, weeks rhythms.

5 - Water levels of the lakes of Alberta have a 34 year cycle.

6 - Tides have 13 different rhythms.

7 - Intrusion of warm water in New England fishing grounds has a 21 year period.

8 - Extremes of annual low level of Nile - 202-210 year rhythm.

9 - High and low sea level in low latitudes - 567 year cycle.

ENTOMOLOGY

1 - Abundance of sugar cane hoppers 4-5 year rhythm.

2 - Outbreaks of cotton moth average about 21-22 years.

3 - 17 year "locusts" - certain broods have a life cycle of 13 years.

4 - Two species of European cockchafers have a 3-4 year life cycle and a 4-5 year life cycle respectively.

5 - Certain locusts have a 9 and 11 year

rhythm of migration.

6 - Abundance of gipsy moths in Europe - 40 year period.

7 - Abundance of insects in Georgia - 2 week rhythm.

8 - Bronze cutworm in Canada averages 6.3 year cycle.

9 - Eastern tent caterpillars - 9-11 year cycle.

10 - Noxious insects in Germany - 12 and 30 year rhythms.

MAMMALOGY

1 - Mortality of certain monkeys - 7 year rhythm.

2 - Rabbits, coyotes, lynxs, muskrats, red foxes, martens, wolves, minks - 9-7/10 year rhythm of abundance.

3 - Caribou - 35 year cycle.

4 - Mice, shrews, arctic foxes, lemmings 4 year rhythm.

5 - Squirrels - 5 or 6 year rhythm.

ORNITHOLOGY

1 - Ptarmigan - 4 and 8 year cycle.

2 - Horned owl - 9 to 11 year cycle.

3 - Northern shrike, snowy owl, and rough-legged hawk - 3 to 5.

4 - Red grouse in Scotland - 6 year cycle.

5 - Gos-hawk, grouse - 9-7/10 year cycle.

6 - Ducks, crows, magpies - 34 year cycle.

7 - Pine grosbeak - 5 or 6 year cycle.

SOCIOLOGY

1 - Periodicity of skirt width - 100 years.

2 - Périodicity of skirt length - 100 years.

3 - Decolletage length - 71 years.

4 - Decolletage width - 154 years.

5 - Waist width - 93 years.

6 - Waist length - 71 years.

7 - Shape of women's dresses - tubular, bell, backsidedness - 33-35 years each. - Complete cycle 105 years.

8 - Periods of emotional excitement in the U. S. average interval 25 4/9 years.

BOTANY

1 - White pine seeds - 5 year period of abundance.

2 - Carnation, Mexican iris and certain other plants normally bloom rhythmically and all together.

3 - Abundance of apples and pecans - 2 year rhythm.

4 - Tree rings in the tropics where temperature and humidity are uniform show rhythms of 3 months, 3 years, and other lengths.

5 - Rhythms like tree rings in the structure of plant cells and cotton fibers are due to daily temperature variations.

6 - Tree ring cycle alleged to have 92, 46, 34, 22-23, 19, 17, 14, 11, 3, 9 plus, 8.4, 7, 5.7,year rhythms.

PSYCHOLOGY

1 - Rhythm in emotions of individual male workers in large variety from 3 to 9-1/4 weeks depending on the individual.

TERRESTRIAL MAGNETISM

1 - Magnetic activity - 11.12 year cycle.

2 - Magnetic pulsation has a 27 day rhythm. The magnetic pulsations themselves have periods ranging from 20 to 180 seconds.

AGRONOMY

1 - Agricultural productivity has an 11 year cycle, both alleged and denied.

2 - Agricultural activity - 18-6/10 year cycle.

3 - Crop yields have a 3-1/2 year rhythm

SEISMOLOGY

1 - Earthquakes have 19 year, 11 year, 1 year, 6 month, 14.8 day, 1 day, and 42 second rhythms.

2 - Earth movement in Los Angeles harbor has a 7 2/3 month rhythm.

VOLCANOLOGY

1 - Volcanoes tend to erupt in 65 year cycles, every second of which, 130 years, is greater.

METEOROLOGY

1 - A rainfall period of 1/9 of the sun spot period (11.12 years) has been noted.

2 - Drought shows an 18-6/10 year cycle.

3 - Tide in the atmosphere - 12 year cycle.

4 - A 27.3-day tide in the atmosphere, i.e. 27.3 day rhythm of barometric pressure.

5 - Weather - 7 and 32 years in length.

37 cycles from 12-1/3 to 9.7 and 7 more from 11.4 to 35 years.

6 - Cycle in barometric pressure slightly over 2 years.

7 - Oscillation in temperature in Northeastern United States - 2 years.

8 - Direction of wind and extent of rainfall in Southport and elsewhere, and in temperature of Greenwich, England - 5-1/10 years.

9 - Regular alternation of dry and warm, and wet and cold periods of 35.5 years.

10 - Barometric pressure - 15.2 year rhythm.

11 - Rainfall, temperature, and barometric pressure - 11-1/4 month rhythm.

12 - Scores of additional examples can be given. Sir Napier Shaw listed 149 examples in his one book alone and most rhythms alleged in tree rings (botany) and sedimentary deposits (geology) are merely reflections of climatic variations.

ECONOMICS

1 - Wheat prices in England from 1260 to date - 54 year rhythm.

2 - Similar rhythm in average wholesale prices in U.S.

3 - Wheat prices in western Europe show rhythms of the following lengths:

2.735 years
3.417 years
4.417 years
5.100 years
5.400 years
5.667 years
5.933 years
7.417 years
9.750 years
11.000 years
12.000 years
12.800 years
15.250 years
17.335 years
20.000 years
36.000 years
54.000 years
68.000 years

4 - European Business cycle - 5.4 years.

5 - The dominant cycle in most American heavy industry - 41 months.

6 - The dominant cycle in building activity in U. S. - 18-1/3 years.

7 - Minor residential building cycle - 33 months.

8 - An important cycle in industrial common stock prices in U.S. of 41 months.

9 - Second most important rhythm in wholesale prices in U.S. - 9 years.

10 - Most important rhythm in industrial common stock prices in U.S. - 9 years.

11 - Most important rhythm in common stock low prices in U.S. - 18.3 years.

12 - Another rhythm important in common stock prices - 36 months.

13 - Copper prices and a few other commodity price and industrial production figures, 11-1/12 year rhythm, - relatively unimportant.

14 - Sugar prices and orders for cotton gray goods and some other industrial series show 20.3 week rhythm and 6.7 week rhythm concurrently.

15 - Many industrial and commercial figures show a rhythm of a little over 9 months.

16 - Most consumer goods industries, retail stock sales, etc., are strongly influenced in the short term moves by a 33 month rhythm.

17 - The stock market has been alleged to have a 10 year rhythm.

18 - Stock market has also been found to show a very minute fluctuation that corresponds to the lunar month, almost insignificant, however, except for scientific interest.

19 - A number of industrial show rhythms of 44 and 48 months.

20 - An export rhythm of 15.2 years.

21 - Price fluctuations have been found to show rhythms of 3, 5, 7, 9, 10-1/2, 11, and 13 years.

22 - Purchasing power of beef cattle varies in a cycle 14.8 years long.

23 - Strikes seem to reach a crest at 7-1/2 year intervals.

24 - Similar rhythm exists in electric power production.

25 - Common stock prices, hemp prices, and a number of other price series - 11-1/4 month rhythm.

26 - Scores of additional examples can be given.

MISCELLANEOUS

1 - Internecine wars in China have a period that repeats itself at 800 year intervals.

2 - Rhythm in solar radiation of a little over 6 years has been found.

3 - A similar rhythm of seemingly the same length has been found in hemp prices, ton miles, and business conditions in the Pittsburg district.

4 - Calcium metabolism - 16 day cycle.

5 - Spruce bud worm - 40 year rhythm.

6 - The red blood count in male human beings has a 4 week cycle.

7 - The number of twins born shows a 6 month cycle.

8 - Influenza after pandemics - 7-6/10 month rhythm.

How it Came Out

A PROJECTION OF FIVE CYCLES IN COPPER PRICES

DURING 1953 and early 1954 we isolated and projected five cycles in copper prices. The length, strength and timing of each of these five cycles are shown in the following table.

Length	Strength Relative to Trend		Time of A Crest
	Above	Below	
32.36 months	2.33%	2.27%	2nd Q. 1958
8.60 years	11.9%	10.7%	4th Q, 1950
9.28 years	14.3%	12.5%	1st Q, 1956
12.53 years	8.4%	7.7%	4th Q, 1952
14.8 years	5.6%	5.4%	2nd Q, 1959

I have already reported to you upon the 8.60- and the 9.28-year cycles (*Journal of Cycle Research,* Vol. 3. No. 4, Fall 1954, p. 99; *Cycles*, Vol. VII, No. 9, September 1956, p. 241). I shall report to you in regard to the other three cycles as soon as possible.

Forecast Shows Five Cycles Only

On March 25th 1954 we combined the five cycles into the broken line shown in the chart below. This line is made up merely of the five cycles, each according to its proper timing and its proper weight. It contains no trend and no allowance for inflation. It is shown as percentages above and below trend. The line does not include any of the other cycles undoubtedly present in copper prices. In the chart the combination or synthesis is plotted only from 1st quarter 1952 through 4th quarter 1962. However, from the information given in the table above, anyone can make the combination and can project it forward and/or backward as far as he wishes.

The actual price of copper (Electrolytic, New York, in cents per pound) from 1st quarter 1952 through third quarter 1956 is shown bv the solid line. This solid line is made heavy from 1st quarter 1954 forward to show how prices unfolded after the forecast was made. As you can see, the forecast has been pretty good for timing, very poor for strength.

Buy-Sell Data

The actual buy and sell dates called for by the synthesis are as follows:

Buy..........2nd Quarter 1954
Sell.........1st Quarter 1956
Buy..........2nd Quarter 1957
Sell.........2nd Quarter 1958
Buy..........3rd Quarter 1960
Sell.........1st Quarter 1961
Buy..........2nd Quarter 1962
etc.

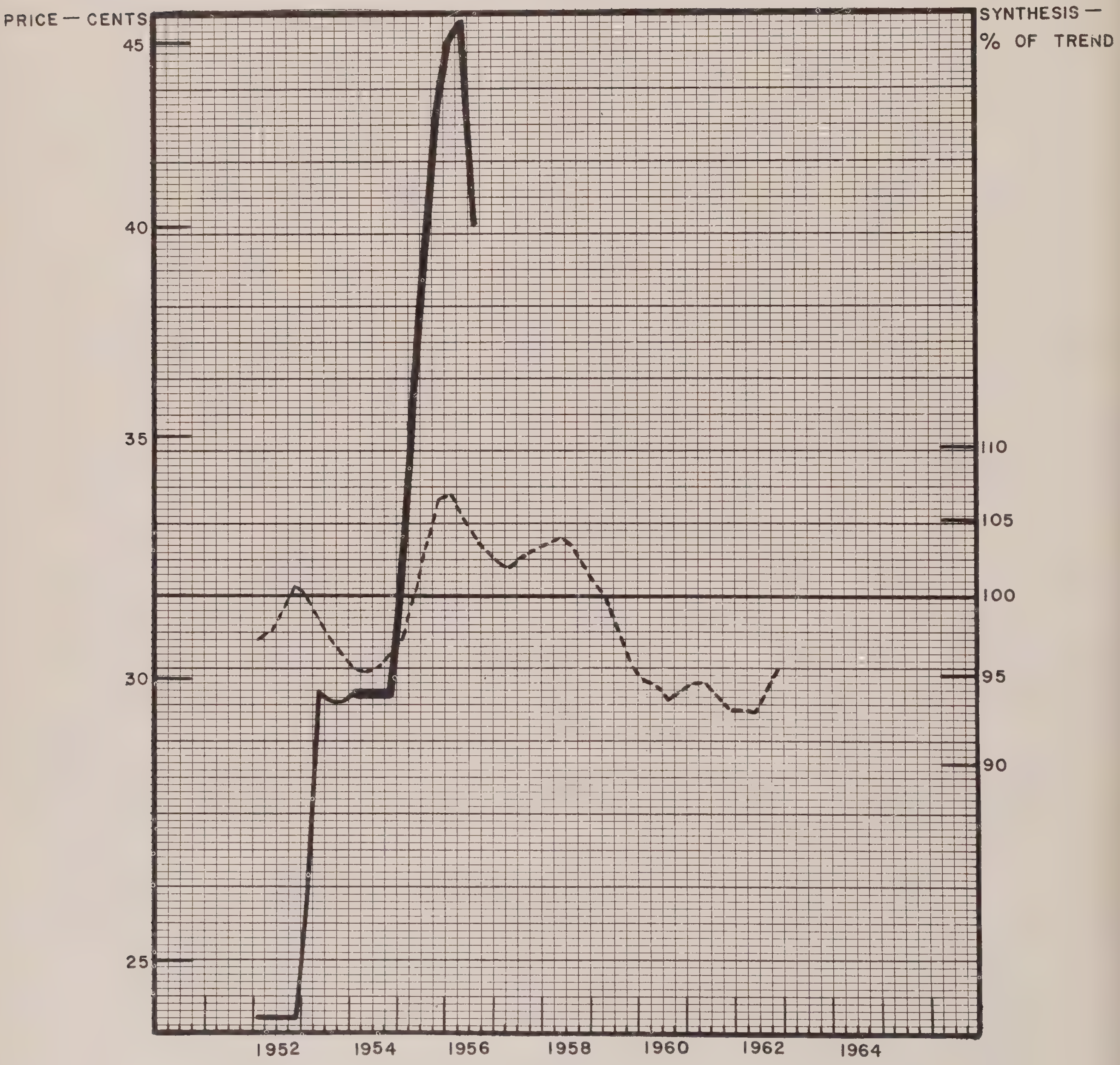
Profit 51.6%

This synthesis is not advanced as a formula for the purchase and sale of copper. However, it is interesting to note that if you had bought copper at the average price of 2nd quarter 1954 you would have paid 29.70% a pound; if you had sold at the average price of the 1st quarter 1956 you would have got 45.02¢ a pound. This would have given you a gain of 15.32¢ a pound, or 51.6%.

We have no way of knowing whether the short position 1st Q 1956--2nd 1 1957 will work out profitably, but as I write (Oct. 1956) the price is down to 39.63 , a gain of 5.56¢ or 12.2%.

Everything is all right so far, as the man was heard to murmur as he fell past the 17th story window!

E.R.D.



COPPER PRICES

Broken line: Synthesis of 32.36-month, and 8.6-, 9.28-, 12.53-, and 14.8-year cycles, 1st Q 1952—4th Q 1962. Note that no trend and no allowance for inflation is included. Synthesis made March 25, 1954. Scale for synthesis in percent. Ratio Scale.

Solid line: Actual price of copper 1st Q 1952—3rd Q 1956. Line is heavy from 1st Q 1954 to show behavior from date of synthesis. Scale for copper prices in cents per pound. Ratio Scale.

THE 1956 POSTSCRIPT

TO

CYCLES—THE SCIENCE OF PREDICTION

PART X: THE 8-YEAR CYCLE—CONCLUDED

"HERE is something that I think will interest you," I said to Robert Steele as we resumed our talk about the 8-year cycle.

"What is it?"

"It's a diagram of all the various 8-year cycles that I know about—or at least all of those for which I know the dates of ideal time of crest." [See chart on pages 310 and 311.]

"That *is* interesting," said Robert. "I like having them staked out that way so that I can see them all at once. It's a pretty impressive display."

"I'm afraid it's not as good as it looks. The things referred to did not go up or down as regularly as this diagram indicates. The diagram shows the *ideal* cycle. Of course in some cases the cycle is quite good. However, in other cases you can hardly trace the cycle in the actual figures. In other instances the cycle is present merely on the average. The one thing about the chart that is really impressive is the fact that these alleged 8-year cycles all crest at just about the same time. You remember I told you last week that all the crests came within a year and a half one way or the other from typical timing. (Typical timing is 1952.9 and 7.95 or 8 years forward and backward from that date.) I think this chart brings that fact out very forcibly."

"Why do some of the diagrams stop 20, 40, or even 50 years ago?"

"Because that's as far as the figures go in which the cycle was discovered. I haven't yet had time to dig up the remaining figures to see how they came out."

"Tell me about each of these 8-year cycles," said Robert.

In Lynx Abundance

"I'll do the best I can, but in some cases I don't know too much." I answered. "Take the first cycle diagramed for example."

"Lynx?"

"Lynx. All I know about this cycle is to be found in the reference I gave you last week. In that article Wing reports that, after lynx abundance figures have been adjusted for trend, for 9.6-, 9.0-, and for 7.46-year cycles, a 7.95-year cycle remains. He shows that it has a strength of 22.7% above trend at time of crest, 18.3% below trend at time of trough. He shows that it is present on the average from 1739 through 1872 and from 1810 through 1944. He shows that a crest comes ideally about 1951.25. He shows step by step how he arrived at his results. He shows that the cycle has been present as a rhythm.

"From the information given any competent analyst could reproduce his work. Although I could wish that his exposition had been a bit fuller, I think he has made a pretty good case for a cycle of this length in these figures."

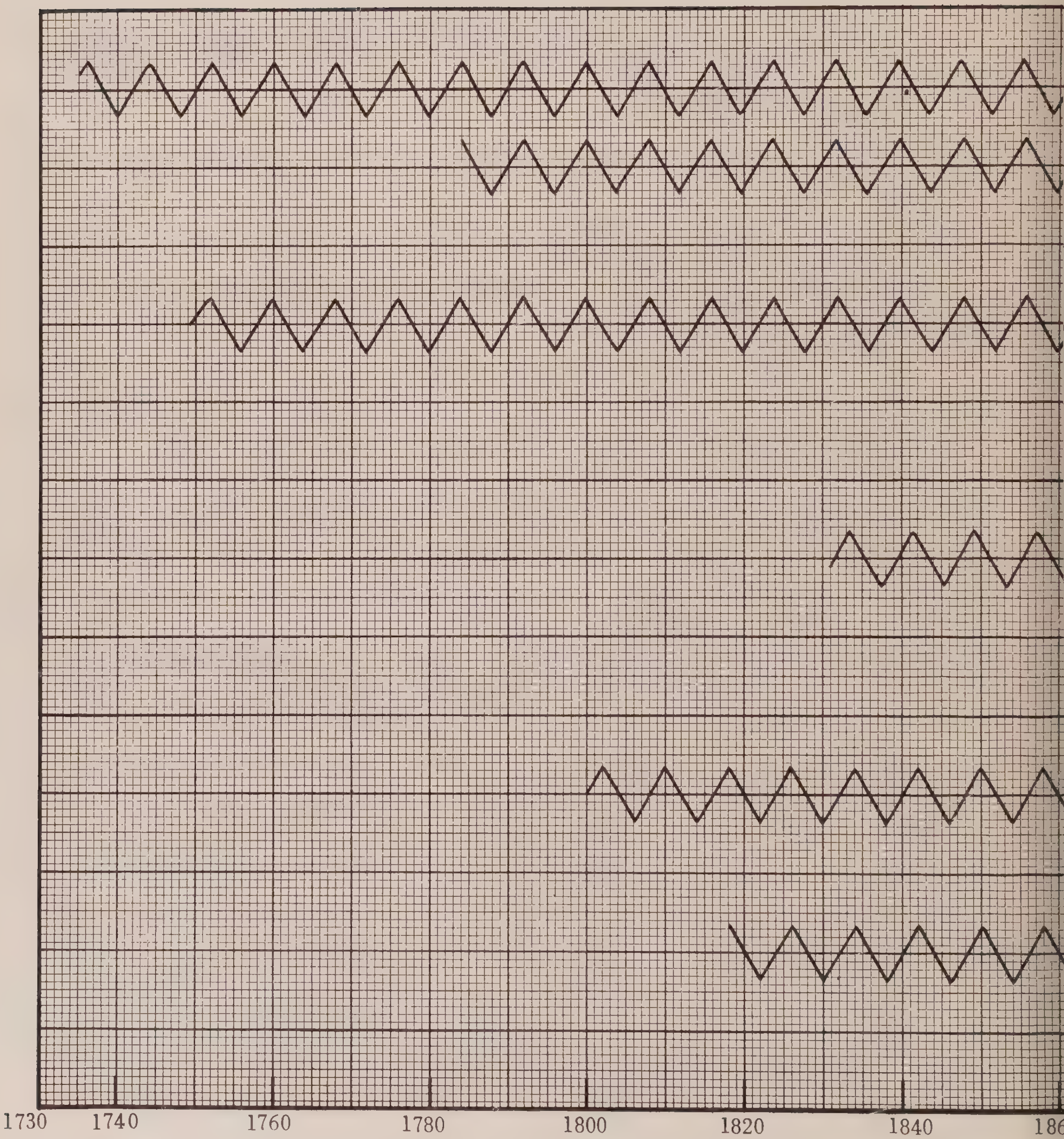
"Are you completely convinced?"

"It's pretty hard to convince me about any cycle, but I think Wing shows enough to justify tentative acceptance of a 7.95-year cycle as a minor cycle in lynx abundance."

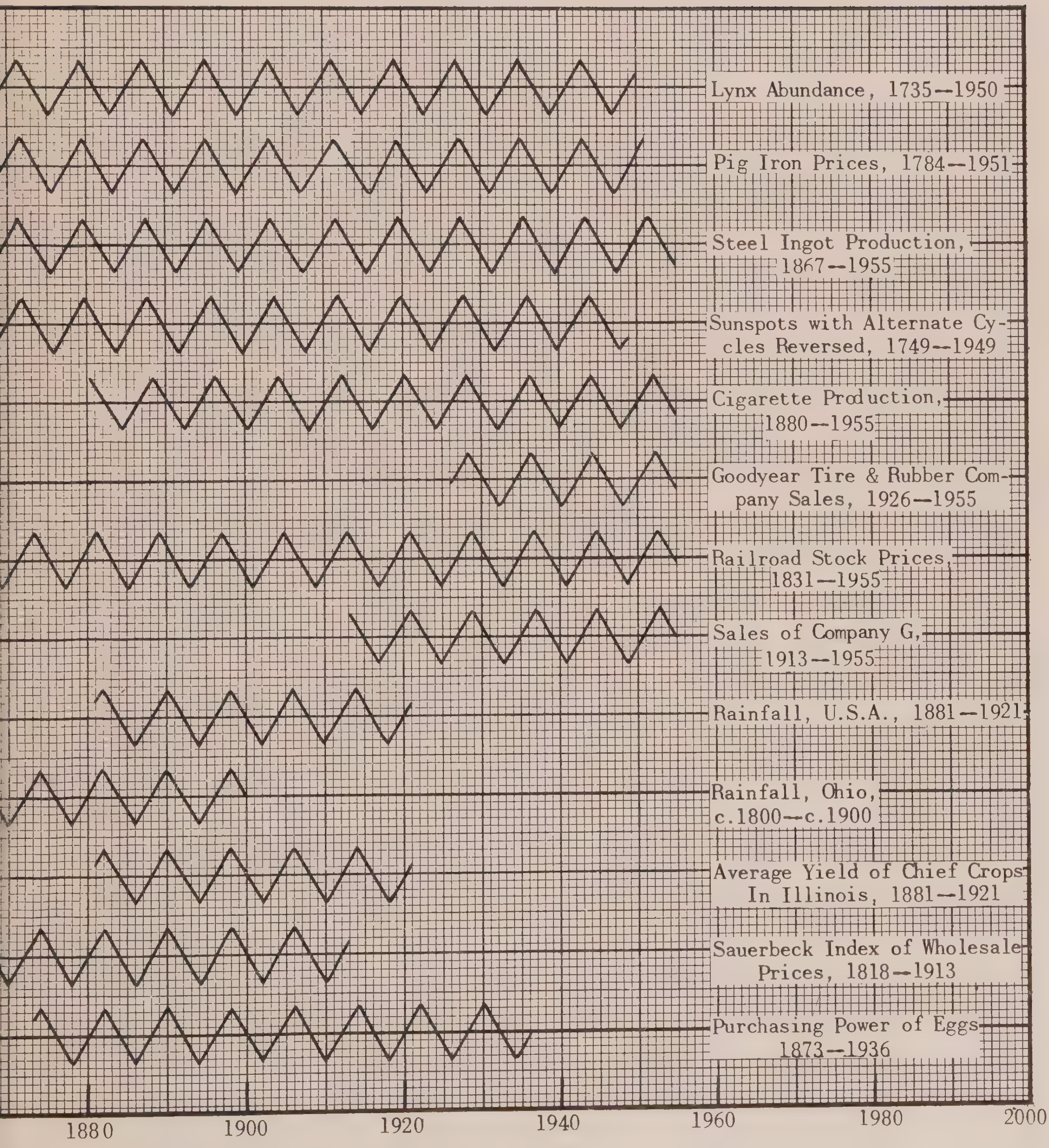
In Pig Iron Prices

"How about the 8-year cycle in pig iron

DIAGRAM TO SHO



THE 8-YEAR CYCLE



prices?"

"It is not visible as a rhythm in the actual figures, or even in the figures adjusted for trend and for the 9.2- and 8.5-year cycles. On the other hand, a multiple harmonic analysis of pig iron prices, 1784—1951, shows a fairly strong cycle 7.95 years long present on the average in these figures."

"It seems to crest about the same time as the lynx 7.95-year cycle, doesn't it?"

"Yes," I said. "It crests in 1951.5, three months later. I determined this timing by constructing a 7,95-year periodic table, Incidentally the cycle has a strength of 2.7% above trend at time of crest, 2.6% below trend at time of trough."

"It would be going up at the present time, wouldn't it?" said Robert.

"Yes, since 1955.5 and until 1959.5," I said. "Of course this cycle isn't important enough to dominate, but it should ease the decline called for by other cycles."

"Isn't it nice all the cycles don't go down at the same time!"

"It certainly is!" I answered.

In Steel Ingot Production

"I see the next cycle on the chart is steel ingot production. It crests a hair later, I see."

"Yes, at 1952.0, six months after pig iron prices."

"Is it a good cycle?"

"No, if by a 'good' cycle you mean one that can be seen time after time like the 8-year cycle in cigarette production. It is more like the 7.95-year cycle in pig iron prices. You can detect it only when you average a number of 8-year sections so that the randoms and other cycles 'wash out.'"

"Do you think it is real?"

"I don't know. The series of figures is rather short; you can't actually see the cycle repeat time after time; and the cycle is not too strong (5.7% above trend at time of crest; 5.4% below trend at time of trough). On the other hand crests and troughs fall at about the time that other better substantiated 8-year cycles turn. I don't feel that I know enough about this cycle in these figures to pass judgement upon it, but I'd say wholeheartedly that it is well worth a full investigation."

In Sunspots With Alternate Cycles Reversed

"The sunspot diagram that's next on the page is a nice long one."

"Yes, but as I told you last week, it represents merely the timing of an 8-year cycle, if there is one. A cycle a little longer or a little shorter—say 8.05 or 7.95—might fit the behavior a little better and have slightly different timing. The matter has not been studied."

"I don't understand what you mean by sunspots with alternate cycles reversed." said Robert.

"Well, to start at the beginning, sunspots are areas on the surface of the sun that are cooler than the surrounding surface and therefore appear darker. As yet no one knows what causes them.

"The number of spots increase and decrease, as you know, in a rhythm which averages a little over 11 years from crest to crest.

"Also, as you doubtless know, sunspots evidence magnetism. This fact is revealed by the spectroscope. The spots act as if they were north poles or south poles of huge magnets situated within the sun.

"Again, sunspots usually come in pairs, a north or 'positive' spot associated with a south or 'negative' spot.

"Finally, in one 11-year cycle in the northern hemisphere of the sun, 'negative' or south-seeking spots will tend to lead; in the next 11-year cycle in the same hemisphere, 'positive' or north-seeking spots will tend to lead; then the pattern repeats and for the next cycle 'negative' or south-seeking spots lead again; and so on. (In the southern hemisphere the situation is reversed.)

"About 20 years ago, C. N. Anderson of the Bell Telephone Laboratories said to himself, 'If one cycle represents an increase in "positiveness," and the next cycle an increase of "negativeness," why not use the zero line as an axis and represent the "negative" cycle below the line?'

"When he did this he got a series of figures he called 'sunspots with alternate cycles reversed.' I find more correspondence of wave length between terrestrial cycles and sunspots with alternate cycles reversed than with the sunspot numbers themselves."

"I wonder why?" asked Robert.

"I don't have the faintest idea." I answered.

In Cigarette Production, In Goodyear Tire & Rubber Company Sales, and In Railroad Stock Prices

"You told me last week about the 8-year cycle in cigarette production, in Goodyear Tire & Rubber Company sales, and in rail stock prices. Have you anything to add?"

"Nothing except these two charts showing its derivation in rail stock prices. [See pages 290 and 291; 292 and 293.] They merely illustrate in chart form what I told you last time."

In Company G

"The next cycle on the diagram doesn't go back very far." said Robert.

"No, and for that very reason I'm not sure if it's significant. All I can say is that on the average there is a cycle of this length in the sales of this company. It comes at the time indicated (1953.25). It has an average strength of 12.7% above trend at time of crest, 11.3% below trend at time of trough. But it cannot be seen as a repetitive rhythm. I can't make up my mind whether it is significant or not."

In Rainfall

"The rainfall charts are not up to date are they?" said Robert.

"No," I answered. "But as soon as I can I want to see how the cycle came out in these rainfall figures."

"If they continued, it will certainly bolster your theory of an 8-year cycle."

"I don't have any theory of an 8-year cycle." I answered somewhat crossly. "I'm not trying to prove a theory. I'm trying to find out the facts. If the 8-year rainfall cycle continued, fine. If it didn't, fine. When we get all the facts assembled it will be time enough for a theory."

In Crop Yields in Illinois

"I suppose that goes for the next curve, too?" said Robert.

"Yes."

"I wonder what crops Moore used for his index of crop yields?"

"Wheat, oats, potatoes, and hay. I'll bring this chart up to date too, as soon as I can."

In Wholesale Prices

"Wholesale prices ought to be easy to bring up to date."

"Yes, but not this particular index. However, we now have other indices that not only cover this same period and come up to date but also go backwards to 1749. These other indexes should be searched for an 8-year cycle, 1818—1913. If found, we should see if it was present backward 1818 to 1749 and if it continued forward 1913 to 1955."

In the Purchasing Power of Eggs

"I see the last curve deals with an 8-year cycle in the purchasing power of eggs."

"Yes. I wrote Professor Pearson who did the earlier work and asked him for the figures to bring his curve up to date. He answered that I wouldn't want them because the 8-year cycle in these figures did not continue. I really did want them whether the cycle continued or not, but I haven't had time to write again."

Summary

"What do you really think of the 8-year cycle?" asked Robert.

"I think there is something to it. You can't reasonably have a cycle repeating as a rhythm for over 200 years—over 27 times—just by chance. And you can't reasonably have a cycle in 13 different things all cresting at approximately the same time just by chance, either. The cycle may not stand up in all of the places where it has been observed, or other cycles may temporarily obliterate it, but I think it is something to reckon with. Don't you agree that there is something here we ought to know more about?"

"Yes." said Robert.

"And the nice thing about the cycle," I continued, "is that it is going *up* at the present time. Wherever we find it, it is exerting an upward force. Where it controls, this means an upward movement. Where it does not control, it serves to mitigate a decline."

E.R.D.

Letters

Axe Houghton Stock Prices Index

Dear Mr. Dewey:

Your article in the August 1956 issue on the 46-month cycle in stock prices and comments thereon was most revealing. The article states that the study was on the Axe-Houghton Index of Industrial Stock Prices. I have never had occasion to use this Index and I do not find the Index appearing in the usual financial trade publications. I am familiar with the Dow-Jones Averages for industrials and railroads and I wish to inquire from you:

1. Whether this study would apply with equal force to these averages.

2. What percentage (if any) can be used to compare the Dow-Jones Averages to the Axe-Houghton Index.

I would very much appreciate receiving this information at your earliest convenience.

Yours very cordially,
M. H. B. . . . .*

New Haven, Conn.

In Reply I Said:

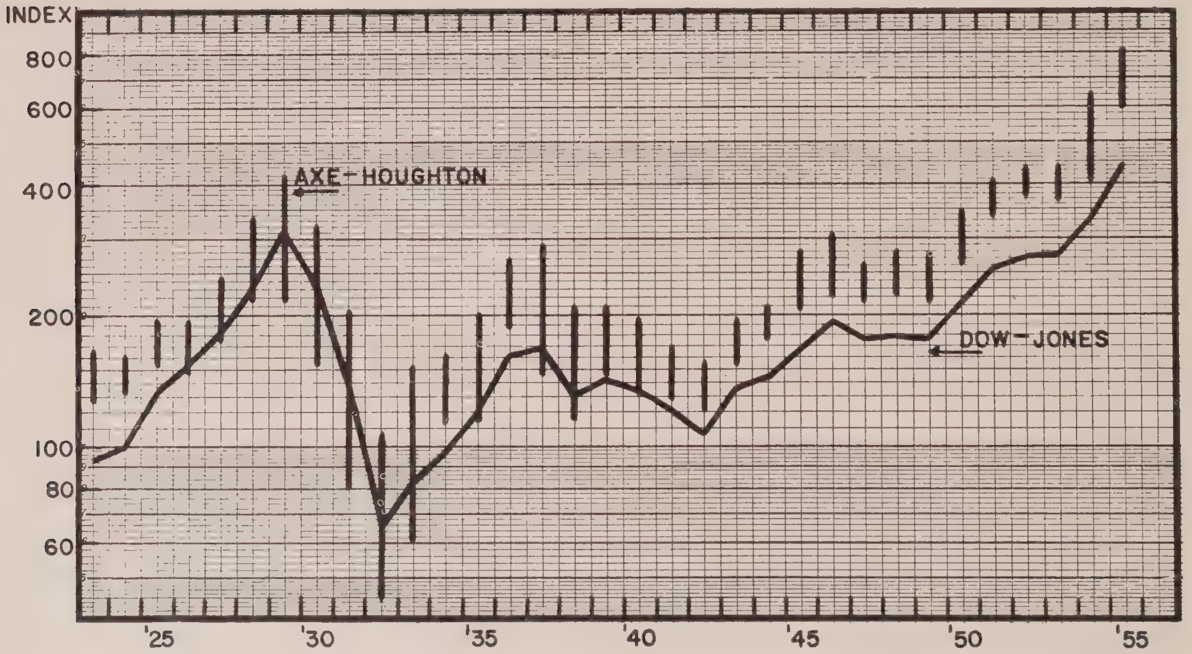
Dear Mr. B. . . .*

I think the best way to answer you is to chart the Axe-Houghton Index and the Dow-Jones Index on the same sheet of semi-log paper so you can see the extent to which they do or do not correspond. I enclose a chart that shows these relationships.

Cordially yours,

---

*NAMES OF CORRESPONDENTS NEVER USED WITHOUT PERMISSION.



Industrial Stock Prices.
Bars of the Axe-Houghton Index show the yearly high and low.
The Dow-Jones curve is of yearly averages.

A Correction by Veryl Dunbar

Dear Mr. Dewey:

Referring to your article on the 46-month cycle in stock prices (*Cycles*, August, 1956), I notice a difference in the method used for arriving at the high and low indexes for the years 1952, 1953 and 1956 compared with the method used for previous years .

The indexes shown prior to 1952 are the absolute monthly highs or lows of the Axe-Houghton Index, and not an average of the high and low indexes for the month in which the absolute was reached. To be consistent with the historical data therefore, the index for 1952 should be 440.4 rather than 426.4 and the index for 1953 should be 365.0 rather than 377.5. The percent depreciation would then be 17.1 rather than 11.5.

I do not have the indexes for 1956 at hand, but presumably the index of 821.6 is also an average for the month of April.*

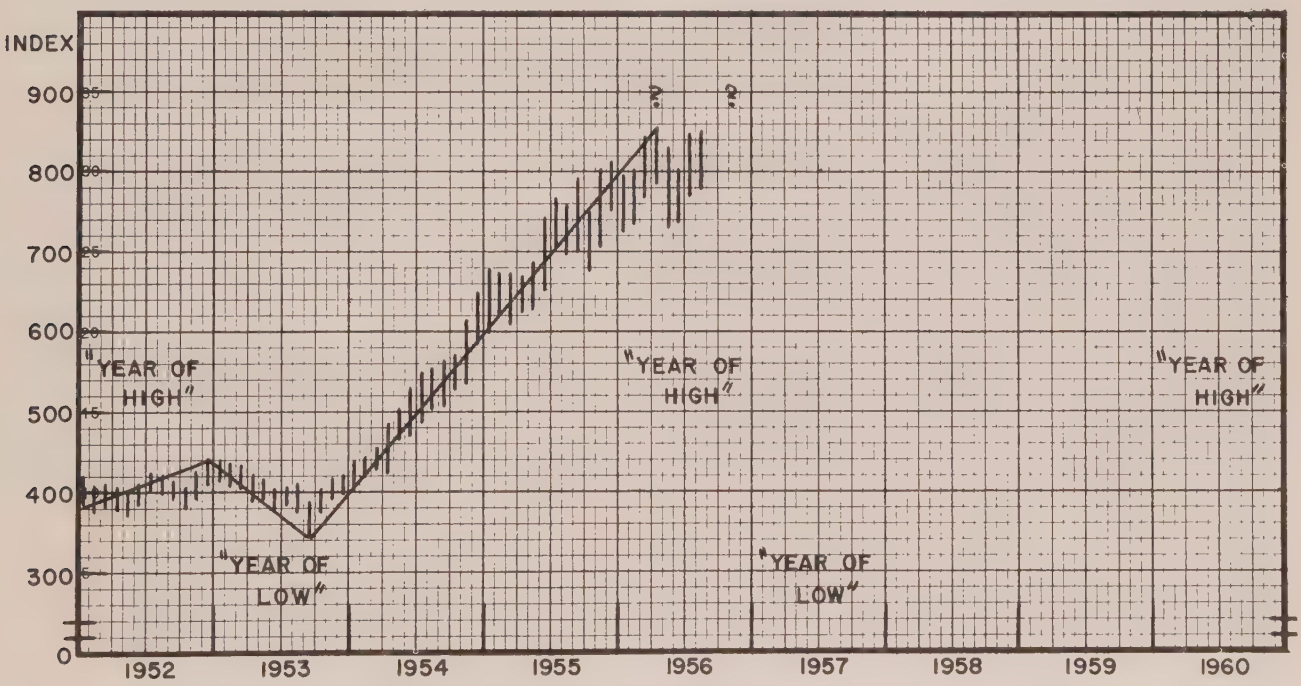
The method used previously is thought to be consistent with the common reference to the Dow-Jones Averages which reached a low on September 15, 1953 at 254.36 for the Industrials and 90.39 for the Rails, with percent of appreciation being figured from those points. In any event I thought I should clarify this matter since it does have an effect on the percent of appreciation and depreciation.

With sincerest regards,
Veryl L. Dunbar

3415 Shaw Avenue,
Cincinnati 8, Ohio

***Editor's Note:** The high for April was 856.8. This value would make the gain 134.7% instead of 117.6% obtained with the use of averages.

E.R.D.



AXE-HOUGHTON INDEX OF INDUSTRIAL STOCK PRICES, JANUARY 1952—AUGUST 1956.

"Years of High" and "Years of Low," according to Dunbar's 46-month cycle are indicated. A line diagrams the decline from the high of 1952 to the low of 1953; the high of April 1956. This high may of course be exceeded during the latter part of the year.

THE MODIFIED GEISINGER INDICATOR

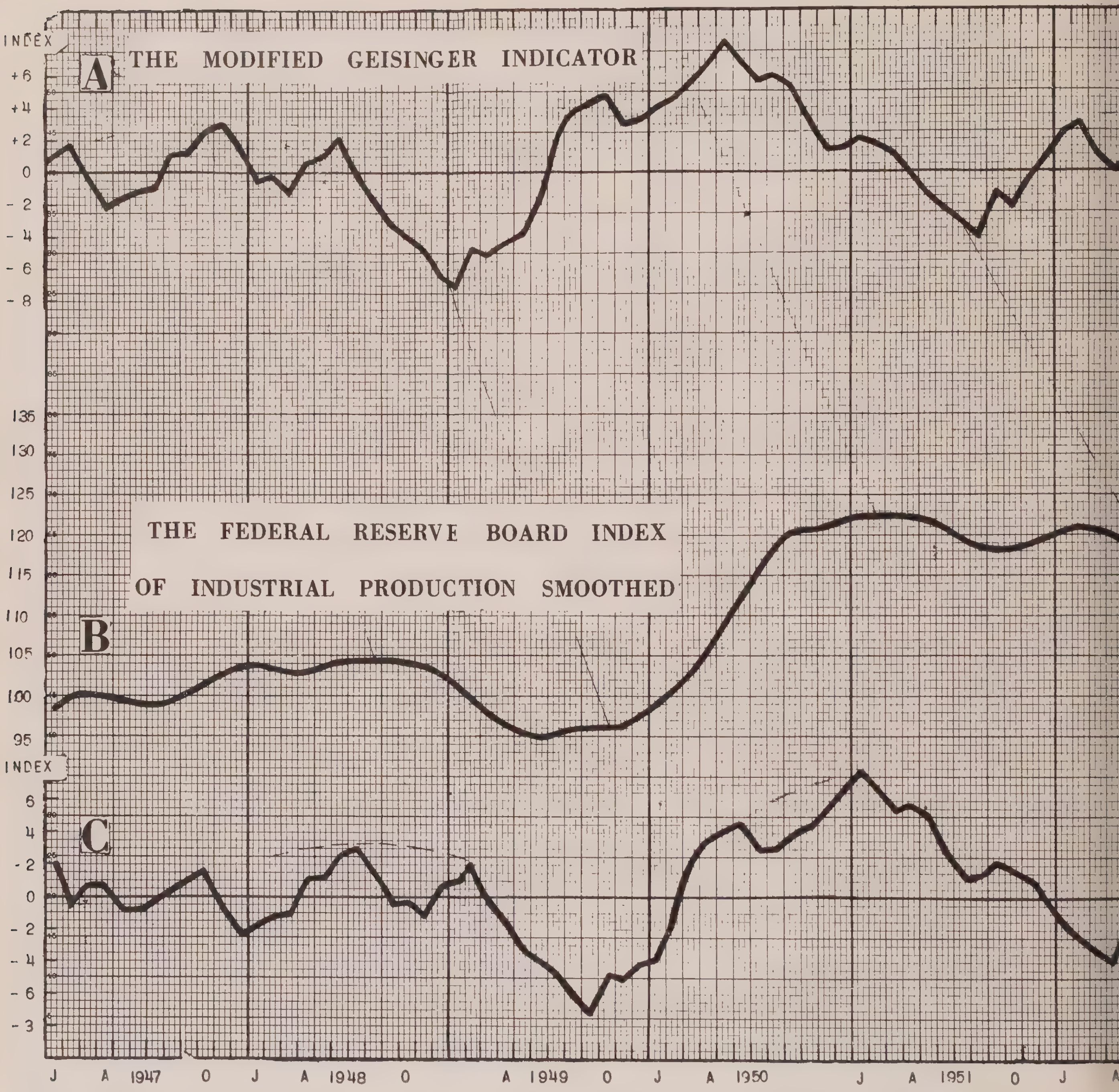
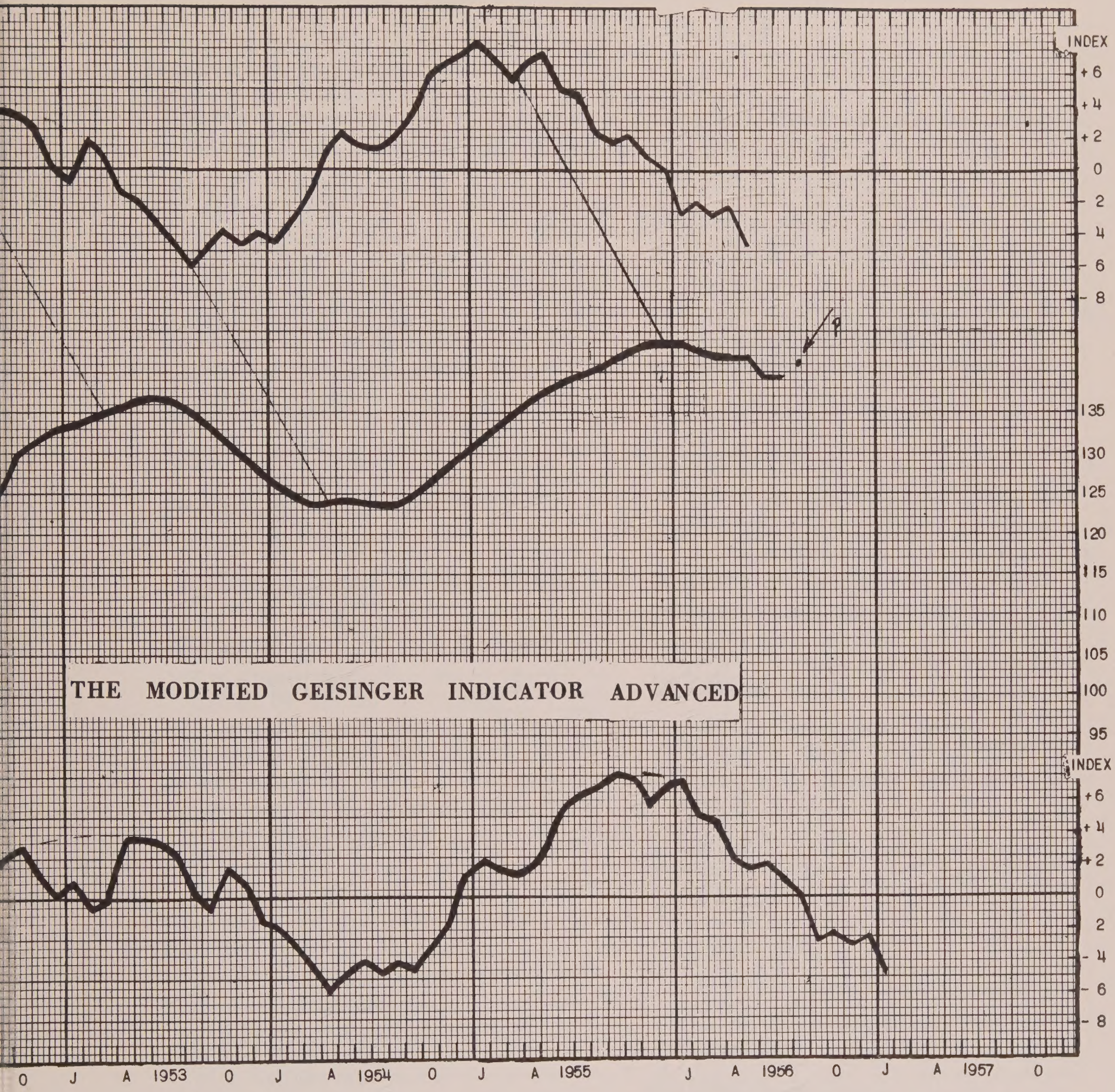


Fig. 1. Curve A. The Modified Geisinger Industrial Production Indicator Curve. This curve is derived from certain figures which are published monthly in the *Survey of Current Business.* It tends to turn about 8 months before the Federal Reserve Board Index of Industrial Production.

Curve B. The Federal Reserve Board Index of Industrial Production adjusted for seasonal variation and smoothed by a 3-month moving average. The value for the latest available month is shown by a dot.

Curve C. This Curve is the Modified Geisinger Industrial Production Indicator Curve advanced by 8 months. This process projects part of the curve into the future. If the relationships of the past continue, the projection gives some hint of what may happen to the Federal Reserve Board Index of Industrial Production (Curve B).

OF INDUSTRIAL PRODUCTION



THE FORECAST

The Modified Geisinger Indicator for January 1957 (May 1956, projected) has dropped to -4.66.

You will remember that the value for December 1956 (April, projected) was -2.46.

The Federal Reserve Board Index of Industrial Production for August is 141 (p); back to where it was in June before the steel strike.

The Modified Geisinger Indicator has behaved similarly three times before: At the end of 1948, followed by the softness of 1949; at the end of 1953, followed by the softness of 1954; and at mid 1951 followed by the *leveling* of 1951-1952. The failure of the F.R.B. Index to continue the decline started at the beginning of this year suggests to me that the precedent of 1951-1952 is more likely to be the one to be followed in the present instance than the precedent of 1948-49, or 1953-54. Remember, too, that the Modified Geisinger Indicator is devoid of *trend*, and that the F.R.B. Index has a basic underlying upward growth trend of about 3.3 points a year.

E.R.D.

September 30, 1956

GLOSSARY

Cycle, coming from a Greek word meaning circle, implies coming around to the place of beginning. Strictly speaking, in the word itself there is no necessary implication of regularity, but the word is often used loosely to denote rhythm or periodicity.

When the word cycle is modified by a time interval such as 6-year cycle, 20-month cycle, 17-day cycle, the phrase usually means a cycle that recurs with reasonable regularity. In other words, it denotes rhythm.

Rhythm, coming from a Greek word meaning measured time, implies a beat, or a tendency toward perfect regularity or periodicity. It is what we really mean on most of the occasions when we use the word cycle.

Cycle analysis, as we are using the term in this bulletin, should really be called rhythm analysis, as we are concerned with **rhythmic cycles**--cycles that recur with a beat.

Periodicity, in the strict sense, is the quality of being regularly recurrent. It is a quality not often found in nature. The ideal cycles which are often added to a chart to diagram a rhythmic cycle are true periodicities.

A **wave** is one single cycle or undulation. Waves have **frequency**, **amplitude**, **period**, and, at least when they represent harmonic curves, **phase**.

Frequency is the number of complete vibrations to and fro--i.e. waves--per second It is a term not used by cycle analysts when dealing with cycles that are over a second in length.

Amplitude is the extent of a vibratory movement measured from the average position to an extreme position; that is, it is the height or depth of the wave above or below the axis around which the wave oscillates.

Positive amplitude is the distance above the axis, **negative amplitude** is the distance below the axis, **overall amplitude** is the sum of the positive and negative amplitudes. Amplitudes may be expressed in absolute units or as a percentage of the value of the axis.

Period is the interval of time required for a periodic motion to complete a cycle and begin to repeat itself. It is the length of the wave from crest to crest or trough to trough or from some other point on the curve taken as the **epoch**. The **epoch** is the point on the curve chosen as the beginning of the wave. In physics and astronomy it is usually taken as the point where the curve crosses the axis on its upward motion, but it may be any other point as well.

Phase, in a simple harmonic curve, is the point or stage in the period to which the oscillation has advanced considered in relation to a standard position or assumed instant of starting. It is measured along the axis, usually in degrees. By extension of meaning, **positive phase** is therefore the part of the wave above the axis or trend, and **negative phase** is the part of the wave below the axis or trend. When the crests (or troughs) of two or more different series of waves come at the same time, the waves are said to be **in phase** with each other. When the crests of one series of waves coincide with the troughs of another series, the series are spoken of as in **reverse phase**.

A **simple harmonic curve** referred to once or twice above, is the curve you would get by tracing the motion of a pendulum upon a piece of smoked paper that was moving at uniform speed at right angles to the direction in which the pendulum was swaying back and forth. It is perfectly simple, regular, and symmetrical and, in mathematical study, is usually referred to as a **sine curve**. A single oscillation is called a **sine wave**.

A **rectilinear** or **saw-tooth wave**, on the other hand, is a wave the sides of which are straight lines; in other words, zigzag.

Trend is the tendency of data in a series to increase or decrease during a long period of time. The expression, "a long period of time," cannot be defined except relatively. If you are dealing with hourly figures, you might consider trend as the general direction over the past 30 or 40 hours. With yearly figures "trend" might mean the general tendency over the past 100 years or more.

An **average** is a typical value which tends to sum up or describe a number of figures. There are at least five different kinds of averages commonly used by statisticians; but the one which ordinary folk think about when they hear the word **average** is the one computed by adding all the items together and dividing the total by the number of items. Thus, if we have four items, 10, 12, 11, and 13, the average of these items is 10 + 12 + 11 + 13 (46) divided by 4, or 11½. An average of this sort is more accurately called the **arithmetic mean**.

An arrangement of numbers is called a **series**.

When the numbers with which we deal represent events which occur one after another in time, the arrangement is called a **time series**. Thus, in the example above, if 10, 12, 11, and 13 represent the price of cotton for each of four consecutive years, or represent the number of accidents on each of four consecutive days, you would call the numbers by this name--a time series.

You could still average the numbers and say, for example, that the average price for all four years was 11½ cents, or that during the period there was an average of 11½ accidents per day, as the case might be.

You could also say that the average price for the first three years was 11 cents, (10 + 12 + 11 (33) divided by 3) and that the average price for the last three years was 12 cents (22 + 11 + 13 (36) divided by 3).

A **moving average** is a succession of averages secured from a series of numbers by dropping the first number (item) in each group averaged and including the next number in the series after the group, thus obtaining the next group to be averaged, and so on.

Thus, when you averaged the first three numbers of our time series (10, 12, and 11) and got 11, and then dropped the first number (10) and added the fourth number (13) and averaged again and got 12, you were constructing a moving average

Because you were averaging three items at a time, you would call the result a 3-item or 3-term moving average. If the items represented yearly values you would call the result a 3-year moving average. If the items represented daily values, you would call the result a 3-day moving average.

The **moving total** is the series of successive totals from which the moving average is computed. For example: When , above, you added 10, 12, and 11 to get 33, and then added 12, 11, and 13 to get 36 (as a step in the task of getting 11 and 12, the two terms of the moving average), you were computing a moving total.

THE JOURNAL OF CYCLE RESEARCH

Did you know that we issue another publication? It is called the *Journal of Cycle Research*. It is a little more formal than *Cycles*. It is issued quarterly. It costs $4.00 a year. Why don't you subscribe for a year to see how you like it? Do it *now!*

Here is a list of the articles printed in back issues, Vols. 1 and 2. They are still worth reading! Back copies cost $1.00 each.

VOLUME 1, No. 1 1951-2

Editorial Page

An Economic Cycle: The 17-2/3-Year Rhythm in Liabilities of Commercial and Industrial Failures in the U.S., 1857-1950, by Edward R. Dewey

Cycles in Canadian Pacific Railway Freight Traffic, by G. Meredith Rountree

Cyclic Trends in Arctic Seasons, by Leonard W. Wing

Synchronized Cyclic Processes, by Jerome R. Tichy

News and Notes

(Temporarily unavailable. Will be able to fill order later.)

VOLUME 1, No. 2

Guest Editorial, The Study of Cycles by Harlan T. Stetson

War Cycle and the 6-year Cycle in Cotton Prices 1731-1949, by Edward R. Dewey

Causation of the Nine-or-Ten-Year Salmon Cycle, by A. G. Huntsman

A new Form of Periodogram, by Edward R. Dewey

VOLUME 1, No. 3

Editorial: Cycle Conferences Needed

Pig Iron Prices in the United States, 1784-1951, by Alla Malinowski

The 17-3/4-year Cycle in Pig Iron Prices 1784-1951, by Edward R. Dewey

Testing Cycles for Statistical Significance, by Charles E. Armstrong

VOLUME 1, No. 4

Guest Editorial: Cycles in Animal Populations, by J. R. Dymond

The 8-month Cycle in Sunspot Number 1749-1950, by Gerould T. Lane

VOLUME 1, No. 5

The 9-2/3 Year Rhythm in Rainfall, by Edward R. Dewey

The 14-2/3 Year Cycle in the Number of Strikes in the United States, by Edward R. Dewey

Standard Month Numbers

VOLUME 2, No. 1 1953

Trends and Cycles in the Production of Rayon, by Edward R. Dewey

A Composite Index of Lynx Abundance 1735-1950, by Leonard W. Wing

(Temporarily unavailable. Will be able to fill order later.)

VOLUME 2, No. 2

Editorial: A Cycle Primer

Cycles of Lynx Abundance, by Leonard W. Wing

Brief Articles:

Cycles in Flight Years of Snowy Owl, Evening Grosbeak, and Pine Grosbeak

VOLUME 2, No. 3

Editorial: Along Cycle Trails

Cycles of European Partridge Abundance, by Leonard W. Wing

VOLUME 2, No. 4

The 9.2 and 8.5-year Cycles in Pig Iron Prices, by Edward R. Dewey

The Sunspot Cycle A.D. 301-1950, by Justin Shove

Dates of Break-up and Freeze-up of the St. John River at Fredericton, N. B. by Bruce S. Wright

Flood Stage Records of the River Nile, by C. S. Jarvis

Standard Quarter-year Numbers

Mr. H. A. Musham
741 No. Rush St.
Chicago, Ill.

YOU

You have some friends who would be interested in *Cycles*, don't you?
(OR DON'T YOU HAVE ANY FRIENDS!)

Why not give them memberships for Christmas? Cost, $10 for 1 year; $16 for 2 years.

We'll send them cards to tell them that the gift is from you.

FOUNDATION FOR THE STUDY OF CYCLES

680 WEST END AVENUE, NEW YORK 25, N. Y.